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CONTROL OF BUSH SICKNESS IN SHEEP.

THE ATIAMURI EXPERIMENT WITH IRON LICKS.

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IN the *Journal* for March last was given a brief interim account of an outstanding experiment, conducted at Messrs. Hill and Sons' Atiamuri Station, for the control of bush sickness in sheep by means of iron licks. The experiment was carried on for a further few weeks, and the strikingly successful result obtained from the limonite treatment now calls for a full record of the undertaking.

As in the case of other co-operative experimental work with farmers in the bush-sick districts, the results at Atiamuri were attained with a minimum of surveillance by Government officers. The plan, once decided upon, was carried out by the station manager and his assistant with only that amount of superintendence which Mr. C. R. Taylor, analyst's assistant, stationed at Rotorua some twenty miles away, could give during his periodical visits, which had to be restricted as much as possible owing to the desire to save travelling-expenses. Any idea that this experiment was of the nature of a State or fertilizer company's farm demonstration, and therefore might possibly be considered by farmers as having been conducted in a manner which they could not afford to follow in actual practice, must not be for a moment entertained. Further, the whole expense of the experiment, including the cost of losses on the control or untreated group of animals, in which the mortality of ewes and lambs was only that expected to occur, was borne by the owners of the run.

To Mr. Taylor a very large share of the credit for the success is due. Once the desirableness of having a thorough test of limonite treatment of sheep was decided upon by the writer, the whole matter was left in his hands to arrange with a suitable farmer. The scheme of work was therefore settled by him in consultation with the manager of the station, Mr. T. V. Humphrey.

FORMS OF IRON USED.

Towards the end of 1930 it was becoming increasingly evident that the supply of spathic iron ore was likely to be insufficient and too costly to supply the needs of farmers desiring a cheap, efficacious iron lick for stock. It was thought from theoretical considerations, and

also remembering the success which had attended the use of iron oxide and salt lick with cattle in the Kenya experiments conducted by the Rowett Institute, that it was advisable to try how far this experience with cattle could be extended to sheep. It was not known which particular iron oxide was used in Kenya, but it was assumed—somewhat hastily it seems—that Scotch bog iron, an impure limonite, was the form. However, this now turns out to be erroneous; the material actually used in Kenya was hæmatite, an oxide of iron which differs considerably from limonite in the water of constitution content. The experiments started in May, 1931, are therefore the first, so far as is known, that have been attempted using limonite as the iron remedy in a lick, and thus the New Zealand Department of Agriculture is entitled to the credit of first using a compound which may prove to be more suitable than the more insoluble hæmatite. In a circular to users of iron ammonium citrate in the bush-sickness districts, issued on 20th May, 1931, for the purpose of securing as many tests as possible, the writer mentioned limonite in the following paragraph:—

> As an alternative to this particular form of iron (the native carbonate), which is extremely hard and difficult to grind, there is yet another local iron ore, which is found in softer form and is more valuable commercially. This is the *hydrated oxide known as limonite*, which is used in fairly coarse condition as a purifier for coal-gas. This is, therefore, already on the market, and when mixed with salt may prove efficacious in the prevention and cure of bush sickness.

Mr. Taylor (who since October, 1929, has been in charge of the farmers' experiments in the Rotorua districts, which were being conducted apart from those carried out at the Mamaku Demonstration Farm under different management) was instructed at the end of February, 1931, that in order to cope with the difficulty of obtaining a supply of material from New Zealand sources for making an iron lick it was desirable for him to arrange a parallel experiment using carbonate in one, and hydrated oxide (limonite) in another. It was further mentioned that the Onekaka oxide, of which a supply was stored at Mamaku, could also be tested; also that if a test at the same time could be made with the iron ammonium citrate it would make the information obtained all the more complete. It was found, however, that the Onekaka iron was too gritty* to be palatable to sheep, and the experiments were started in May, 1931, in pursuance of the following scheme, which had been agreed to tentatively in March.

From the Atiamuri Station flock 200 ewes were selected and divided into four lots each containing fifty, each group to be grazed and treated exactly alike except for access to the following licks:—

No. 1, control, had no lick.†
No. 2 had access to a lick containing iron ammonium citrate and salt.
No. 3 had access to a lick containing hydrated iron oxide (Whangarei limonite) and salt.
No. 4 had access to a lick containing native iron carbonate (Huntly spathic iron ore) and salt.
(No. 4 experiment was discontinued; see March *Journal*, p. 194.)

Twelve ewes in each group were weighed periodically throughout the term of the experiment.

* Onekaka iron is now obtainable from the works, Golden Bay, Nelson, in a form fine enough for use as a stock lick.

† In previous years rock salt or iodized salt had both been supplied without overcoming the malnutrition.

In June Mr. Taylor also was advised that "any great demand on iron carbonate could not at present be met, so that the limonite experiments should be pushed on, as there are unlimited quantities of that material available, and it contains twice as much iron as the carbonate." In the meantime the matter had been taken up with Messrs. Reyburn and Co., Whangarei, the owners of a deposit of limonite, and in August Mr. Taylor was advised that this firm would supply farmers for cash with material of approved fineness at a cost, f.o.r., of £5 10s. per ton for quantities of ½ ton or over, and for lesser quantities at 6s. per cwt. The firm also promised to erect suitable machinery for producing a very fine product as soon as the demand warranted the outlay. Messrs. Reyburn, who had already a well-established trade in supplying gas companies with coarsely ground limonite, were informed that the Department was seeking a suitable form of iron for use in the bush-sick areas. They then submitted a sample of the screened product which they were able to supply without installing special machinery. They were warned against employing artificial heat, and were asked to employ air-dried material in order to ensure that it was in as natural a state as possible so far as the solubility was concerned. The difficulties of drying, screening, and transporting the fine material were discussed, and trial lots were prepared for analysis at the Department's Chemical Laboratory. The results from Messrs. Reyburn's samples are given in Table 1 under Nos. A/1114 and 1115. Another firm, S. C. Crawford, Whangarei, also entered the trade in dealing with Whangarei limonite; analysis of a sample from this firm is given under No. B/976.

Table 1.—Analyses of Limonite Samples.

Sample No.	Date received.	Description.	Moisture at 100°C.	Loss on Ignition, including Water of Combination.	Insoluble Residue.	Sesquioxide of Iron (Fe_2O_3).
A/1114	12/3/31	Whangarei—unscreened	9·16	11·31	7·83	68·0
A/1115	12/3/31	Whangarei—screened	10·32	11·53	9·39	63·5
B/976	19/11/31	Whangarei ..	1·31	..	..	78·4
C/127	9/5/32	Onekaka ..	3·53	10·70	20·8	59·5

Fineness of Grinding.

	A/1114.	A/1115.	C/174.*	B/976.	C/127.
Retained on 2 mm. sieve ..	9·8	Trace	Trace	Trace	Trace.
,, 40 mesh sieve..	67·8	18·6	3·8	Trace	Trace.
,, 60 ,, ..	3·3	15·4	19·4	Trace	Trace.
,, 80 ,, ..	2·4	11·7	15·0	Trace	Trace.
,, 100 ,, ..	1·9	7·1	13·2	6·5	6·0
,, 120 ,, ..	1·0	4·9	2·6	8·0	14·0
,, 150 ,, ..	1·3	4·4	5·6	13·0	
,, 200 ,, ..	1·7	7·1	5·0	16·5	8·0
Passed 200 mesh sieve ..	5·7	28·5	35·4	56·0	72·0

* Sample received from Reyburn's, Jan., 1932.

NOTE.—These analyses do not indicate which is the best material to use in making a salt lick for prevention of bush sickness. That can only be determined by a field experiment. The material used in the Atiamuri experiment is represented by sample A/1115.

From tentative experiments obtained with a ton of this limonite, Mr. Taylor reported in September that results from several selected farmers indicated that the limonite was likely to prove a good substitute for the carbonate, stores of which were now almost exhausted. It was necessary to postpone the issue of a circular which Mr. Taylor desired to send out advocating the use of carbonate of iron until it was seen whether the limonite could be relied upon to supplant the carbonate as a preventive for bush sickness. He stated, however, that in his own mind he felt confident that the limonite was capable of producing some very fine results. By this

FIG. I. STACK OF LIMONITE FOR GRINDING, AT REYBURN'S WORKS, RUATANGATA, WHANGAREI.

time Reyburn's were producing a very finely ground product, which Mr. Taylor was advised as a result of laboratory tests should suit admirably as a lick material. The section of this article which follows is largely his own wording.

Locality and Farming Practice.

Upper Atiamuri, where the experiment under review was located, is situated twenty miles south-west of Rotorua, and is roughly the centre of great areas of unimproved country capable of being brought into productivity at small expense and with every prospect of the settlers ultimately making good, especially with the knowledge gained from recent experimental work in the district. Messrs. Hill's property comprises 10,000 acres, two-thirds of which is ploughable, the balance being utilizable as a run-off to the improved areas.

As a general rule the flat country is poorer than the hill slopes, animals thriving better on the latter. Sheep becoming sick on the terraced rubbly pumice country frequently recover when removed to a hillside pasture. This may be ascribed partly to atmospheric

agencies removing the soft light Taupo pumice deposit from the steep faces into the valleys. A sticky brown clayey material underlies the surface soil on the hills but is absent on the flats. The natural vegetation is stunted monoao, bracken, manuka, and tussock. Of the workable country about half is elevated and half flat.

Farming on Hill's property first commenced in 1921 with cattle running on the rough country. Ploughing and grassing were started eight years ago, the usual method adopted being to grow turnips on the first furrow and the second year to disk and sow the grass with 2 cwt. of superphosphate per acre. Nearly 700 acres out of 10,000 have now been broken in in this way. Super at the rate of 2 cwt. per acre has been the top-dressing principally used since, but last year a large part of the farm received a mixture of super and slag (half-and-half) for the first time, a fertilizer which contains available iron in quantity.

Sheep have been carried for eight years, the breed favoured being Romney ewes and Romney rams. For the first year 250 ewes were obtained from Gisborne and Hawke's Bay, and these, wandering over a large range besides the few improved paddocks, did remarkably well; but since then with larger numbers confined more or less to the improved areas, the mortality among the grown sheep has reached at times the alarming rate of 20 per cent. Extensive feeding of turnips during the winter months, and the free use of iron carbonate as a lick for the past few years, has reduced the average death rate to 6 per cent. The mortality for the current year, during which a fair amount of limonite has been used, has not yet been determined, but it is safe to say, all things considered, it will not be very high. (Sheep records are made up annually to the end of June.)

Lambs have always been the main difficulty, and it has never been possible until this year to keep them after the end of January, except perhaps a few odd ones which do well all the time and ultimately make splendid sheep. In the majority of cases, however, lambs commenced to slip back during the months of December and January, necessitating their immediate removal from the property, and selling regardless of price offering. In this way it can readily be seen that it has not been possible to build up a flock of station-bred ewes, and each year it has meant buying in for replacement purposes, a usually rather expensive method in addition to being not so satisfactory. Fortunately the flock lambs this year on limonite lick have done, and still are doing, exceptionally well, and it is believed that they will grow into very fine sheep now that they have progressed so far.

The most important knowledge arising out of the 1930 experiment with iron carbonate was that sheep must first of all be in a healthy condition if they were to remain so on this compound; and, secondly, to be sure of getting good healthy lambs that were likely to do well it was imperative that the ewe should have the iron lick during the whole period she was carrying the lamb. *Good-looking* ewes that were given the carbonate lick for the first time a few weeks before lambing produced very miserable weedy lambs, while remaining, at least outwardly, in splendid condition themselves. Others of a similar type having access to the lick from March produced altogether different lambs, and moreover were able to do them better afterwards. This

point cannot be overstressed and is equally applicable to limonite treatment. Because a ewe *appears* to be in good health on this class of country without lick is no guarantee that she will produce a healthy lamb or be able to rear it properly. It is considered that the majority of lambs that appear to do well up to a point and then suddenly slip back do so because they are starved—the ewe has dried up just as a dairy cow will do when first affected by bush sickness, although she may look in other ways quite normal. During the past season in districts where cattle are affected many cows apparently in good condition gave birth to most weedy calves and then went completely to pieces themselves, necessitating in some instances many months of care and treatment to restore them to health again. All this could quite simply have been avoided if ordinary common-sense methods had been adopted from the first and farmers would only realize the actual cause of their troubles. If would appear that many of the parasitic troubles one meets with in the bush-sick districts in lambs, calves, &c., are due probably to the general low condition of affected animals, bush sickness making them favourable hosts to the further development of larval forms.

Progress of the Experiment.

Little or no difficulty was experienced in getting the sheep chosen for the experiment to take either the iron carbonate and salt lick or the limonite and salt lick, possibly owing to the absence of any characteristic flavour in these iron compounds and the fact that the sheep were accustomed to a plain salt lick prior to the commencement of the trial. Whenever difficulty has arisen it has *always* been very simply overcome by taking a few of the sheep to be treated or given lick and shutting them up in a very small area, such as a sheep-yard pen, and practically starving them for four or five days if necessary, with only a trough of lick and a few chopped up turnips, or a handful or so of grass thoroughly mixed up with it before them. The idea, of course, is to compel the sheep through starvation to eat the turnips or grass carrying the lick and so acquire a taste and liking for it. It has never been necessary to keep the animals penned for longer than five days, whether they appear to be taking the straight-out lick or not, so long as they have freely taken the turnips or grass. By then they have usually acquired a taste for the lick, know what it looks like, and are not afraid of the receptacle containing it. The trained sheep can now be put back with the rest of the flock, and they will educate the others into taking the lick. About six sheep per one hundred are all that are required for this purpose.

With regard to the actual feeding of the lick, it has been found that it is desirable to keep it as dry as possible, especially during the winter, as it is inclined to set rather hard on the surface and stock do not then take it in anything like the quantity necessary to keep them healthy. As a matter of fact, in the majority of cases it has been noticed that both sheep and cattle avoid it altogether in this condition, but once stirred up they partake of it quite readily again. With cattle, of course, it is almost an impossibility to feed lick to them in such a manner as will keep it dry, except in dummies in the cow-shed, but it is such a simple matter every three or four days, if necessary, or when happening to pass a lick trough in the course of

FIG. 2. LIMONITE-FED LAMBS IN THE ATIAMURI EXPERIMENT. PHOTO TAKEN 12TH APRIL, 1932.
Note size and good condition generally.

FIG. 3. LIMONITE-FED EWES, 12TH APRIL.

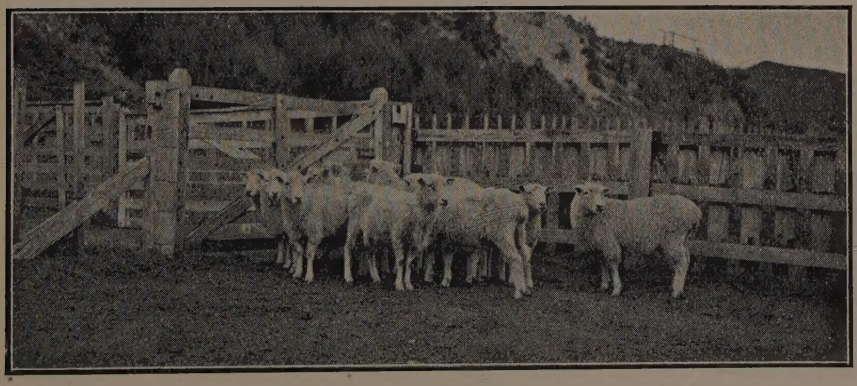


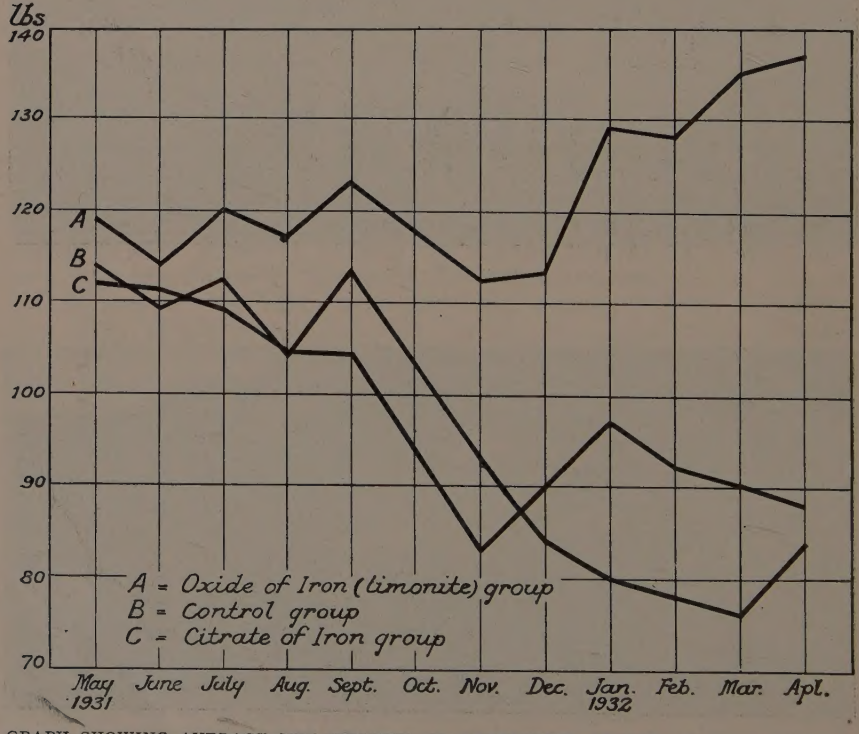
FIG. 4. SURVIVING CONTROL EWES (NO LICK), 12TH APRIL.

the daily round, to just give it a stir with a stick or pocket knife that no one need be afraid of the work being laborious or likely to occupy too much time. The results are worth it.

A trough similar to that illustrated in the *Journal* for April last, page 288, should be used for feeding the lick. Mr. Taylor has found the following methods best for feeding lick to stock, his remarks being quoted:—

"Carefully observe where the sheep congregate most, and place there a trough. In every paddock the sheep have a place where they camp of a night, and this makes an ideal site for a trough. If a paddock is flat to undulating the higher knobs will usually be found the favoured position. Slopes are usually preferred to valleys. In all cases common-sense is all that is required in the placing of troughs. It has been found that one trough to 20 acres, suitably placed, gives satisfactory results, but here again discretion must be used to make the most of local conditions.

"Dairy cows have done and are still doing well when fed a simple lick of limonite and salt (half-and-half) with or without molasses, but where little or no top-dressing has been done for a year or so it is an advantage to add 20 lb. to 30 lb. of steamed bone-flour to about 90 lb. of limonite-salt mixture. If practicable the best method of feeding lick to dairy cows is undoubtedly in bail boxes. They each get their share without molestation, and the farmer is at all times in a position to know the behaviour of every individual cow of his herd towards the lick, and can take appropriate measures to otherwise treat a beast which appears to require attention. Troughs of lick in various paddocks may also be put out with advantage."



GRAPH SHOWING AVERAGE NET WEIGHTS OF RESPECTIVE GROUPS OF EWES DURING CURRENCY OF ATIAMURI EXPERIMENT.

Concerning the graph of sheep weights, Mr. Taylor remarks :—

"It is most difficult to give a detailed explanation of all the slumps in weight as shown in graph. The big drop in October is undoubtedly due to lambing, while the further drop in November is due to shearing. After shearing it has always been noticed that sheep in moderate health put on weight for a time fairly rapidly, and this appears to explain the rise between November and January of the limonite and citrate groups—the sick controls still showing a drop in weight over the same period. February weights show a drop due to droughty conditions and scarcity of feed. The rise in weight of the control group from March to April is due to drenching with iron remedy in order to save further loss to the owners."

The live weights of the limonite-fed lambs in the experiment, as taken on 8th February, 1932, were as follows :—

No.	lb.	No.	lb.	No.	lb.	No.	lb.
(1)	95½	(12)	90	(23)	82½	(34)	84
(2)	86½	(13)	52	(24)	84	(35)	46
(3)	61½	(14)	94	(25)	70	(36)	81
(4)	83	(15)	68½	(26)	81	(37)	86½
(5)	95	(16)	72	(27)	61½	(38)	67½
(6)	91½	(17)	87	(28)	72	(39)	72½
(7)	101	(18)	60	(29)	66	(40)	78
(8)	81	(19)	79½	(30)	90½	(41)	71
(9)	66½	(20)	75½	(31)	56	(42)	68
(10)	64	(21)	89	(32)	66	(43)	53
(11)	85	(22)	78½	(33)	84	(44)	58

The live weights of the lambs from the other groups of ewes cannot be given, *as neither in the control nor in the citrate group did any lambs survive.*

A Field-day Demonstration.

A highly successful field-day was held at Hill's station on 20th February last, allowing many farmers from other bush-sick districts to inspect the results of the experiment. General satisfaction was expressed with the effect of the limonite treatment in enabling lambs to be reared. A post-mortem examination of a lamb in the limonite group of ewes, and of another lamb which had survived in the main mob and which had no access to any iron lick, was made on the spot by Mr. D. Marshall, Government Veterinarian from Hamilton. His report embodies his own findings and those of the Wallaceville Veterinary Laboratory, and is quoted as follows :—

Report on autopsies on two lambs from experiment with limonite lick at Hill and Sons farm, Upper Atiamuri, 20th February, 1932: I understand the two lambs were running over the same paddocks: A, from group getting limonite and salt lick; B, control (no lick).

A. Well woolled and well grown, dressed weight 44 lb. Plenty of fat on carcass, also on caul and round kidneys. Liver dark (healthy) colour, firm texture. Gall bladder well developed, kidneys large. Well-developed papillæ on lining of omasum (third stomach). Examinations of lining of abomasum and of small intestine for parasites were negative.

B. Poor lamb, short weak fleece, dressed weight estimated 15 lb. No internal or carcass fat, some excess of peritoneal fluid. Liver pale, friable; gall bladder small; kidneys small, cortex shade browner than normal. Poorly developed papillæ of lining of omasum. Examination for parasites showed these to be numerous, commonest being Ostertagia circumcincta and odd Hæmonchus contortus in abomasum, and Nematodius fillicollis in small intestine.

Size of organs no doubt related to total size of respective carcasses. Blood smears from each and samples were submitted to Wallaceville Laboratory, which reported the following results of examination :—

	Ca. Per Cent.	P. Per Cent.	Mg. Per Cent.	K. Per Cent.
A	11·6	6·2	2·1	37·9
B	10·4	6·2	1·9	31·9

Sample from "A" laked, and phosphate value probably higher than figures show.

Leucocyte count on slides.

	Polymorphs. Per Cent.	Lymphocytes. Per Cent.
A	.. 13	87
B	.. 57	43

To me, the absence of parasites in the limonite lamb, as compared with the other running on the same ground, is most interesting. Both were evidently exposed to infection by larval forms, and either the vermicide action of the salt and iron, or, what is more probable, the general thriving condition of "A" rendered it an unfavourable host for further development.

Limonite as a Cure.

It has generally been considered that insoluble iron compounds such as limonite would be of use only in the form of a lick as a preventive of bush sickness, but that where a cure was required it would be necessary to use iron and ammonium citrate as a drench. A recent experiment, however, indicates that successful results may be obtained with limonite as a drench. Details are given in Table 2, the figures representing live weights in each case :—

Table 2.

Limonite Drench.*		Citrate Drench.†	
Weight before Treatment.	Weight after Treatment.	Weight before Treatment.	Weight after Treatment.
23/3/32 lb.	12/4/32 lb.	23/3/32 lb.	12/4/32 lb.
(1) 52	70½	(1) 80	89
(2) 67	89	(2) 59	81
(3) 63½	81	(3) 56½	69
..	..	(4) 63½	80½

* Twelve drenches each of one level teaspoonful of limonite in 2 oz. water over period of twenty days.

† Twelve drenches each of 2 oz. 6-per-cent. solution over twenty days.

The few sheep treated culled out of the flock were so weak at the commencement of drenching that they could not stand. After the full twelve doses they had so much improved that they were able to stand up to dogging into the yards. The limonite-treated animals gained roughly 20 lb. each in weight in twenty days, and the citrate-treated 17 lb. each in the same period. The experiences of many of Tokoroa farmers and others who have tried limonite as a drench are in full agreement with these observations, and it is anticipated that limonite will ultimately replace iron ammonium citrate even for drenching purposes.

Analyses of Atiamuri Soils.

Analysis of soil-samples taken at Atiamuri show that the healthier soils contain more organic matter than the unhealthy ones. Detailed results are given in Tables 3 and 4.

Table 3.—Chemical Analysis of Atiamuri Soils.

(Results, except *, are percentages on soil dried at 100° C.)

Laboratory No.	Locality.	Volatile Matter.			Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available Plant-food").				Hydrochloric-acid Extract. ("Total Plant Food.")				Lime-requirement, $CaCO_3$.		Remarks.
		* On Air-drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	On Air-dried Soil.	On Soil dried at 100° C.	
	Hill's, Atiamuri.															
A/523	East Taupo, Block 3, B_2 T.C. ..	34·4	3·3	9·6	0·242	0·086	0·019	0·017	0·007	0·51	0·19	0·08	0·07	0·35	0·36	Healthiest but one.
A/525	,, ,, 3, B_4 B.L. ..	21·0	1·3	5·5	0·170	0·089	0·013	0·018	0·010	0·66	0·23	0·11	0·04	0·14	0·14	Sick.
A/527	,, ,, 3, C_1 T.L. ..	34·5	1·6	8·7	0·221	0·071	0·012	0·015	0·006	0·43	0·15	0·07	0·07	0·27	0·27	Sick.
A/529	,, ,, 4, D_4 B.L. ..	37·1	2·6	10·5	0·268	0·093	0·022	0·015	0·010	0·54	0·19	0·08	0·08	0·35	0·36	Healthiest.
A/531	,, ,, 7, J_1 C.I. ..	39·5	1·5	8·2	0·188	0·069	0·016	0·012	0·006	0·55	0·18	0·08	0·09	0·22	0·22	Sick.

Table 4.—Mechanical Analysis.

(Results are percentages on air-dried soil.)

Laboratory No.	Description of Soil. (Classification of U.S. Dept. of Agriculture, modified.)	(Analysis of "Fine Earth" passing 2 mm. Sieve.)								Stones and Gravel.	Loss in Solution.	Remarks.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.			
	Hill's, Atiamuri.											
A/523	Sandy silt (top) ..	5·3	21·2	20·1	24·2	11·3	1·7	3·3	9·4	7·1	4·3	Hill country. Cattle do well; cannot rear sheep.
A/524	Sandy silt (subsoil)	4·1	30·1	24·3	18·0	8·0	1·5	2·6	6·6	5·0	4·1	
A/525	Fine gravelly sand (top)	18·5	55·3	8·6	5·5	2·7	1·3	1·3	5·5	8·3	2·5	Stock sick; 20 ft. above stream terrace.
A/526	Coarse sand (subsoil)	10·9	69·1	10·4	3·0	1·7	0·5	0·6	3·2	11·9	3·0	
A/527	Silt (top)	1·5	14·9	23·2	33·3	14·0	2·2	1·6	8·5	5·8	4·2	Cattle and sheep sick; terrace 200 ft.
A/528	Silt (subsoil) ..	1·4	15·5	24·8	37·2	14·3	1·2	1·0	4·3	3·7	2·7	
A/529	Sandy silt (top) ..	4·6	23·4	19·7	23·2	11·0	2·5	2·6	7·2	6·7	4·5	Healthy country for cattle and sheep; well watered, underlain by sticky clay. Sheep recover when transferred here.
A/530	Coarse sandy silt(sub.)	10·5	33·0	18·0	18·0	8·5	1·7	1·7	6·1	10·8	3·8	
A/531	Sandy silt (top) ..	3·6	21·2	25·0	25·8	10·2	1·5	1·5	8·1	8·5	4·2	Terrace 100 ft. above Waikato; subsoil; coarse to considerable extent.
A/532	Sandy silt (subsoil)	5·4	28·6	22·3	24·5	8·3	1·2	0·9	4·2	9·3	3·6	Soil dry and friable.

Summarized Points.

A considerable advance has been made in the search for a rational and economic remedy for "bush sickness" in sheep; *rational* because some form of iron treatment is indicated as necessary by thirty years of experimenting in field and laboratory, and *economic* because the automatic administration of iron has hitherto been only successful on a small scale or by employing a costly meal containing the iron in the form of iron ammonium citrate.

The search for the right form of iron obtainable in nature in large enough quantities for the purpose has resulted in fixing upon the hydrated oxide of iron called "limonite" (Fe_2O_3 3 H_2O), a brown oxide which is much more soluble in acids than the non-hydrated red oxide, hæmatite (Fe_2O_3). There are inexhaustible quantities of limonite available in the North Auckland District, and other large deposits at Onekaka, Golden Bay, Nelson.

The limonite only requires to be ground extremely finely and mixed with an equal weight of salt to provide an efficient remedy not only for sheep, but also for cattle. If the limonite and salt are scattered on hay or ensilage when the stacks are built there is evidence that the remedy is equally efficient when consumed by stock in this way, so that a method of automatic administration is effected additional to the lick method.

With regard to the feeding of salt to stock, one may say that a fair consumption would be 1 oz. per week per sheep, and about seven times as much for a cattle beast—say, 1 oz. per day. If other materials are mixed with the salt, allowance must be made and the amounts of these added to the amount of salt fed.

These experiments must not be interpreted as throwing any doubt on the efficacy of iron ammonium citrate as a drench or otherwise given by hand to stock. It is now proved that it is inferior to the non-soluble limonite only when fed automatically as a lick to sheep, owing to their disinclination to consume it.

The treatment of the ewe with an iron lick before the lamb is born is regarded as essential to success on this country in raising lambs.

It will be noted from the chemical analyses (Table 3) that the healthiest soils have the highest "lime-requirement," a somewhat misleading term to denote the amount of lime that a soil will absorb in an empirical laboratory test without considering what the effects would be on a coarse highly ærated soil with a great or entire deficiency of colloids. These figures are highly significant in view of the oft-repeated experience that liming of pumice soils is dangerous, that alkaline manures are to be avoided, and that an acid reaction should be maintained in the soil. The hydrogen-ion figures for these soils range from 5·5 to 6·0.

The oxalic acid method suggested for determining the iron available in the soil also gives anomalous results at Atiamuri, the sick soils showing nearly twice as much iron as the healthy soils.

The use of iron sulphate mixed with fertilizer for top-dressing bush-sick pastures has long been advocated as the result of the Agriculture Department's experiments at Lichfield and elsewhere (see article in this *Journal* for December, 1928, entitled "Farming of Bush-sick Country," reissued separately as a leaflet). Fertilizer manufacturers are now acting on this advice, and experimenting with a fertilizer made from limonite and phosphate rock, which would result in a superphosphate containing soluble iron.

NEW ZEALAND PASTURE SEEDS.

WHAT THE DOMINION HAS TO OFFER.

(Concluded.)

E. BRUCE LEVY, Agrostologist, Plant Research Station, Department of Agriculture, Palmerston North.

(5) CERTIFIED NEW ZEALAND COCKSFOOT.

The New Zealand cocksfoot type is essentially a leafy grazing type, as distinct from the seed-production type represented in the Danish and American strains. It is highly persistent, leafy, dense at the crown, and is a moderately good winter grower, as compared with the winter-dormant Danish, Russian, German, Norwegian, and American types. It is not as fine in the leaf as the British indigenous type, or selections from these by Stapledon, Welsh Plant Breeding Station, now well established at the trial grounds in New Zealand. New Zealand cocksfoot is essentially the British indigenous "hay" type.

In a sense for high-production soils the "hay" type is preferable to the much lower-yielding, fine-leaved "pasture" type, which, while it may be excellent for low-production habitats in Great Britain, is too low-producing to warrant a place under conditions that permit of high production. Low-production cocksfoot strains, like low-production rye-grass, white clover, and red clover strains, may be excellent to keep in check such grasses as sweet vernal, brown-top, fine-leaved fescue, annual clovers, rib-grass, catsear, &c., and to help make a sward where ordinary cocksfoot fails; but, as before mentioned, potential high-production strains give greater scope in grassland production, and a good leafy type, such as the British indigenous hay type and New Zealand Akaroa type, is to be strongly recommended. This, at least, is true of New Zealand conditions, and I surmise that it would hold in all parts of the world where high-production grassland habitats abound.

Certified New Zealand cocksfoot is harvested from old pastures mainly about Akaroa, on Banks Peninsula, in the South Island. These areas were sown on bush burns in the early colonization period, and during the intervening time the Akaroa type has been evolved. Until the advent of Danish cocksfoot Akaroa was the main source of cocksfoot for New Zealand requirements and for export. The type has been disseminated to all parts, and it can be said that any old pasture stand in New Zealand is essentially the Akaroa type. Such stands are essentially the mother-seed producing areas, and crops from these after field inspection and plot trial are sealed as certified New Zealand cocksfoot—mother-seed standard. The product of crops sown down with certified mother seed after field inspection and trial represents certified New Zealand cocksfoot — permanent pasture standard—until these areas attain the age of five years, when they become eligible as mother-seed areas.

The Danish cocksfoot is a poor type from a grazing-pasture point of view, in quantity and quality of herbage and in persistence

FIG. 7. SWARD OF NEW ZEALAND COCKSFOOT AND NEW ZEALAND ORDINARY WHITE CLOVER TYPE.

Under good pasture-management New Zealand cocksfoot swards in well with the other species of the pasture; it persists well, and throws feed for a considerable period of the year.

FIG. 8. TYPE OF HILL COUNTRY IN NEW ZEALAND WHERE CRESTED DOGSTAIL DOES WELL, PRODUCING GOOD WINTER AND EXCEPTIONALLY EARLY SPRING FEED.

under grazing. In New Zealand also it winter-burns badly at the first frost and remains comparatively winter-dormant until spring, and as soon as it starts growth in the spring it bolts away to seed. Some samples from America were even more stemmy and more highly seed-producing than the typical Danish forms, while lots from Germany, Austria, Russia, and Norway were similar to the Danish. It would appear from these and other overseas lots under trial that the larger portion of the cocksfoot on the markets of the world is a stemmy, free-seeding, and winter-dormant type. Wherever strain-improvement work has been carried on in cocksfoot, particularly in Great Britain, those improved strains approximate more and more closely to the New Zealand Akaroa type. The fine-leaved British indigenous selections from Aberystwyth, Wales, are the only exceptions.

(6) New Zealand Crested Dogstail.

Crested dogstail is grown to some considerable extent in New Zealand both for local consumption and for export. It is an important pasture grass in the Dominion, more particularly as a bottom grass on second-class country devoted essentially to sheep rather than dairying. Its most valuable attributes are its persistency, by reseeding or otherwise, on moderately low-fertility soils, its ability to establish from seed on surface-sown country, its high palatability, and its good winter and early spring growth. Seed is harvested in the main from short-rotation soil-types, and the crop is cut with the reaper and binder. Stripping is also carried out from old pasture areas. Strain work is in progress in the Dominion on crested dogstail, but no commercial lots of a superior type have yet been produced. New Zealand crested dogstail is of high quality in regard to germination, purity, and appearance.

(7) New Zealand Red Clover—Broad Red Type.

The only red clover type so far produced in New Zealand is the broad red, and there are in New Zealand no areas where specific persistent pasture types have been developed to resemble the Montgomery and Cornish Marl type. Red clover seed production in New Zealand is essentially the business of the short-rotation farm where at most pastures are left down three to four years. None the less, the type of broad red clover produced in New Zealand is decidedly more persistent than certain European types such as Lombardy red, Italian red, and is slightly superior—under New Zealand conditions at least—to the bulk of imported broad red clover from Great Britain. Various names—such as early-flowering red clover, cow-grass, and double-cut cow-grass—have been applied to this type.

The broad red type is the least persistent of all the red clovers. It grows rapidly from seed, and while it lasts easily outyields any other type of red clover. It is early in the spring and flowers earlier in the season than the late red types. Normally little or no seed is set in the early part of the season, due largely to the absence of humble-bees at this period. The spring growth is cut for hay, and a second crop of flowers is produced in early autumn, when seed is set in abundance, and it is at this time that the

seed crop is taken in practice. The average type of plant common in broad red clover is typically lax at the crown at all stages of growth, relatively few tillered, and producing stem rather than leafy growth, especially at mid-season. None the less, there will always be a place in temporary and short-rotation pastures for the broad red clover type, both for the production of grazing and for hay.

The quality of New Zealand Broad Red clover is excellent from a germinating, purity, and appearance point of view, and, while there is no intention at present to certify the crops, these can certainly be recommended for use in Great Britain and elsewhere before any of the low-persistent European broad red types.

(8) Montgomery Red Clover.—New-Zealand-grown Certified Montgomery Red.

Small importations of Montgomery Red clover are being made and trials conducted to confirm the type. Such importations after a satisfactory plot trial are regarded as mother seed, and the resultant crop certified to as New-Zealand-grown Montgomery Red type. Montgomery Red has a decided place in New Zealand, and could with great advantage replace all broad red seedings made in permanent pastures and in long-rotational pastures over three years' duration. Broad red clover is essentially the ideal temporary and short-rotation pasture species, unexcelled for quick feed along with rye-grass and for hay production. In permanent-pasture sowings broad red is inclined to smother during the first year down and then to gradually go out, leaving the pasture poorer than if it had never been sown. Montgomery Red is slower establishing, and it comes away later and extends well into the summer period, where, along with cocksfoot, it carries on after the seasonal decline from the rye-grass and white clover peak.

Great Britain needs the Montgomery Red type, and all the world over there appears to be a growing demand for a red clover type more persistent than broad red. Canada, Russia, Sweden, and Germany particularly are working on and evolving red clover types intermediate between broad red and Montgomery Red clover. Such names as Altaswede, Hersnap, and Late Red are applied to this type. In New Zealand this intermediate type from the countries named and also those from Great Britain are essentially winter-dormant—much more so than broad red and Montgomery Red. In persistency also they range between these two types. Britain seems to lean favourably towards these intermediate late red types, and where winter conditions are too severe for any winter growth from any red clover they may be satisfactory enough, but under the milder New Zealand winters the winter-dormant period is a disadvantage. Montgomery Red clover does not winter-burn in New Zealand to anything like the extent that the intermediate late red types do.

New Zealand has an excellent climate for red clover seed-growing, and if the demand arises could supply the Empire requirement for broad red and for the extra late red clovers of the Montgomery and Cornish Marl type. This does not necessarily mean that growers of the extra late red type in Montgomeryshire and Cornwall will be superseded by New Zealand as a producer of this

FIG. 9. NEW ZEALAND BROAD RED CLOVER IN FULL FLOWER.

Compare with Montgomery Red in Fig. 10, which up to time of photo had identically the same treatment.

FIG. 10. MONTGOMERY RED CLOVER GROWING IN NEW ZEALAND.

The type is essentially different from the broad red. It is dense crowned, multitillered, and late flowering (compare with Fig. 9). These characteristics hold in New Zealand just as they do in Britain.

class of seed. As before stated, no mother-seed areas of these types exist in New Zealand, and an excellent arrangement could be made through New Zealand and British merchants for Montgomery and Cornwall growers to produce and sell certified mother-seed to New Zealand for seed-production purposes. The same applies to growers of Kentish wild white clover. If the world seed-trade demands extra late red, every effort should be made within the Empire for seed of this type to be produced as rapidly as possible, and I can see great possibilities of the areas in Great Britain being earmarked and certified as mother-seed areas, the seed from these to be sent overseas to New Zealand or Australia for increase growing and return. The certification scheme already in operation in New Zealand makes this project immediately practicable and possible. A similar certification scheme should also be inaugurated in Great Britain to ensure that the mother seed supplied to New Zealand is true to type and up to mother-seed standard in all respects.

(9) Lucerne.

Lucerne probably varies more from a strain point of view than any other pasture or fodder plant. So outstanding are strain differences that virtually every lucerne-growing country in the world considers its own strain the best. New Zealand lucerne seed for the most part is grown in Marlborough—the northern portion of the South Island. The Marlborough lucerne does better in New Zealand than any other strain, although Hunter River strain from Australia is scarcely distinguishable from it. All cold country lucernes, such as Grimm, are winter-dormant in New Zealand, and are on this account comparatively valueless. In lucerne the inbred characteristic of winter dormancy is most marked, and, as in the case of rye-grass, cocksfoot, and red clover, even when these forms are grown in a country of milder winters than the country of origin, they still retain this characteristic, so deeply ingrained has it become by years of moulding under definite and distinct habitats.

This, again, brings up the whole point as to what strain of lucerne is best for Great Britain and all other countries that have a moderately temperate climate. As in the case of rye-grass, cocksfoot, and red and white clover, it would appear sound that these countries should import their lucerne-seed requirement from countries as mild or somewhat more mild than their own. For Great Britain's requirement, therefore, New Zealand Marlborough lucerne or Australian Hunter River type should fill the need far better than cold-country lucerne types where the long winter-dormancy characteristics are so deeply inbred. Hot dry-land lucerne types, again, should be avoided, for the conditions under which these have been evolved are not inducive to high-producing leafy types, but to low-production, stemmy, free-seeding, quick-maturing, non-persistent types, and these characteristics must be so firmly ingrained into the plant that even though brought to very much more favourable conditions for growth and high production they are unable to respond to the latter conditions. New Zealand Marlborough lucerne has been tried experimentally in Britain, and, as one would surmise, the type showed up extremely well.

Good lucerne seed crops are produced in New Zealand, the climate and soil of Marlborough favouring high production, good even ripening, and excellent harvesting. The crops are virtually pure lucerne stands, and so dense is the growth that most weeds, including even Californian thistle, succumb to the frequent cuttings possible from the New Zealand strain and from the smother of the quick recovery and excellent growth. The seed-machinery plants in Marlborough have specialized in lucerne-seed dressing, and they turn out samples virtually 100 per cent. pure. The germination is always excellent.

FIG. 11. NEW ZEALAND LUCERNE, SHOWING GOOD LEAF-DEVELOPMENT OF A TYPICAL CROP.

(10) LAWN SEEDS: CHEWINGS FESCUE, BROWN-TOP, AND CREEPING-BENT.

New Zealand ranks as an important lawn-seed producing country. Under our peculiar environment there have come to be produced a type of fine-leaved fescue—Chewings fescue, two types of brown-top (*Agrostis tenuis* vars.), and a form of New Zealand creeping-bent (*Agrostis stolonifera* var.).

These fine-leaved grasses and their varieties constitute the main bulk of fine lawn-seed the world over. Actually the three species and their varieties are dissimilar in habitat requirement. Chewings fescue is suitable for dry low-fertility hard habitat greens and fairways; brown-top is suitable for the stiff, heavier, moderately low-fertility moist class of soil-type; and creeping-bent flourishes best on wet greens and where liberal composting is possible. Brown-top is the grass *par excellence* for greens and lawns, and every effort should be made to attain to the brown-top requirement as regards habitat; in other words, the treatment of the greens and lawns

should be such, or made such, that brown-top may thrive there strong and healthy. Chewings fescue makes excellent greens where competition effects from other lawn plants are small, but the fine-leaved fescues on the whole will not stand such severe cutting as brown-top. Creeping-bent in natural associations is more or less a bog-land grass, and spreads by means of overground stolons or runners. When these runners are buried with compost, and if the lawn or green is kept wet, then a fine playing-green is the result. Under dry conditions and with little or no compost a poor rough green results.

All three species are harvested in New Zealand—Chewings fescue and brown-top far in excess of creeping-bent. There are actually but few areas in New Zealand wet enough to grow creeping-bent on a payable basis. Chewings fescue and brown-top and their varieties, however, will always occupy first place in the making of lawns, and in the production of seed of these species New Zealand may rightly claim that no better and purer seed is produced anywhere else in the world.

Stapledon, dealing with the question of species and strains and seed mixtures for lawns, and enunciating the general principle of "one lawn one growth-form," claims as conforming to this principle a sample mixture of two species—brown-top and Chewings fescue. Quoting Mr. Dawson's experiments in connection with green-keeping research at St. Ives, England, he says: "Most striking, for example, are the plots of New Zealand bent (brown-top) and New Zealand Chewings fescue . . . and it would seem not at all unlikely that in these two grasses we have ready to hand—for the seed of both is harvested on a commercial scale in New Zealand—two forms which to a marked degree conform to the tentative principle which I have enunciated, and which may be expected to blend in an admirable manner if sown together as the sole ingredients in a seeds mixture."

So far as growth-form is concerned Chewings fescue and brown-top are almost identical, both spreading by short underground tillers that later develop multitillered crowns which, blended together, make the ideal turf.

Strain work on brown-top in New Zealand has led to the identification of two distinct types, ecologically and botanically. One type occupies the normal, rather wettish, stiff, sour clays of both Islands, and is the dark-green, broader, flat-leaved form with short underground tillering rootstock. The other occupies what may be termed run-out arable light wheat country, in the drier districts of Canterbury particularly. This form is somewhat finer in the leaf, with leaf often distinctly rolled rather than flat and of a grey-green colour. The rootstock has strong underground creeping stems, by means of which it is able to tide over the dry summer period. The seed-head is more compact and coarser and the ligule is longer than in typical brown-top. Ecologically this dry-land brown-top fits in more essentially with a habitat suitable to Chewings fescue, and the form at once appeals as of great promise in association with Chewings fescue for greens that are too dry for the normal brown-top. It has probably not quite so good a colour as the true

brown-top, being greyish green rather than the normal grass-green. On the other hand, it is a better winter grower and has a much stronger rootstock, and apparently can keep alive and thrive moderately well on drier and more impoverished soils than can the true brown-top. In New Zealand the dry-land brown-top has been studied under lawn conditions for three years, and swards as well as ordinary brown-top and Chewings fescue. Its better winter growth may enhance its value for conditions in Great Britain and America over and above the ordinary brown-top for certain soil-types.

Seed of Chewings fescue, dry-land brown-top, and the ordinary brown-top can be produced cheaply in New Zealand in virtue of

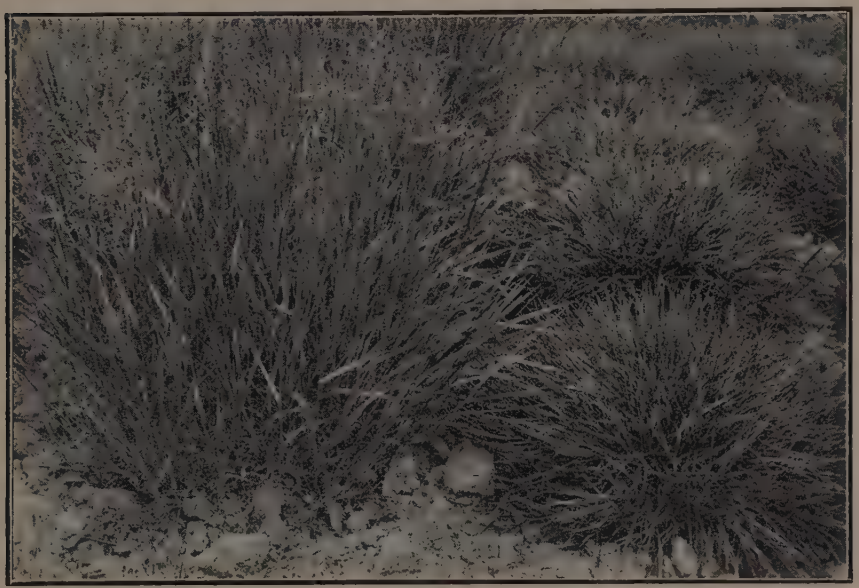


FIG. 12. SINGLE PLANTS OF NEW ZEALAND CERTIFIED BROWN-TOP (RIGHT) COMPARED WITH AMERICAN RED-TOP (LEFT).

The dense multitillered crowns of the brown-top enhance the value of this grass for lawns, whereas the coarse open-natured crown of the red-top renders this species useless for fine lawns.

the fact that pure swards of each can be readily secured over large tracts of country—the fescue by seeding down on very poor soil that agriculturally is very low priced, while the brown-top forms are successional volunteers on short-rotation soil-types, replacing the sown species after three or four years. Both forms of brown-top may be regarded as catch-crops. Cheap and efficient methods of harvesting—in the case of Chewings fescue the reaper and binder, and with brown-top the stripper—are almost invariably employed.

The pure swards and the efficient seed-cleaning plants produce samples in all cases virtually 100 per cent. pure. Purity in lawn seeds is of vital importance, and there are extremely few troublesome lawn weed seeds met with in New Zealand Chewings fescue and brown-top.

Most of the ordinary brown-top now exported is certified true to type and free of red-top. Red-top is probably the worst lawn-grass in the world. Its coarse erect growth and its inability to form a turf under mowing render it quite useless and even harmful in lawns. Under New Zealand conditions at least, there is little likelihood of red-top being present in the ordinary brown-top crops, as red-top readily smothers out under the intense competition set up by a good brown-top sward. On wet somewhat peaty areas, however, red-top may persist, and the certification scheme here is necessary to eliminate these areas from being harvested for seed.

Chewings fescue seed, in common with that of most fescues, is short-lived, and care should be exercised in buying to get current season's crop. Every effort is made at the New Zealand end to get the seed dressed, cleaned, and shipped with the minimum of delay, and overseas importers would be well advised to estimate their requirement well in advance and to place orders in New Zealand as soon as they possibly can after the harvest, which takes place about January.

(11) Other Seeds.

Lotus major, Lotus hispidus, suckling clover, clustered clover, timothy, alsike, Poa trivialis, prairie-grass, Italian rye-grass, Phalaris tuberosa (syn. bulbosa), and Danthonia pilosa (indigenous) are also harvested to some extent in different parts of New Zealand, and can be grown here to perfection if the demand justifies taking up these lines for export. There is also a good opportunity for Britain to use New Zealand more extensively for the raising of vegetable seeds, root seeds, fodder-crop seeds, and flower seeds.

Conclusion.

New Zealand, as has been shown, has some really valuable strains of pasture seeds to offer other grassland countries. It has the climate to produce seed, and machinery to harvest and clean it, unsurpassed by any other country in the world. Its Government scheme of certification, whereby a guarantee of type is given, enables seed-merchants to handle and farmers to buy with the utmost confidence.

Special habitats may require types other than those offering from New Zealand at the moment. New Zealand is prepared to enter into arrangements with any country that has not the climate to produce its own seed to once-grow for return seed of any strains of peculiar value to the country concerned.

Orchard Cultivation.—The Orchard Instructor, Nelson, reports that during the past two years no ploughing has been done in the research orchard at Appleby, tractor cultivation having been substituted. In 1930 an ordinary double-gang disk-harrow was used, followed by a spring-tooth cultivator. In 1931 heavy double-gang cover-crop disks were used entirely, with very satisfactory results. The land is in splendid tilth to a good depth. The Instructor adds that it may be necessary to plough in occasional years as the land may have a tendency to work away slightly from the trees.

THE MANAWATU-WEST COAST DAIRY-FARM COMPETITION.

RESULTS FOR INITIAL YEAR 1930-31 REVIEWED.

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THE general scope, conditions, and operation of the Manawatu-West Coast Dairy-farm Competition were described in this *Journal* for September, 1930, to which interested readers are referred. The conditions of the competition were designed from the outset to ensure that the awards would be determined largely by the financial returns, but that the provision for the sound future conduct and development of the farms would also be taken into account.

Over £70 was readily donated by business and farming interests for the purpose of providing attractive prizes and meeting incidental expenses, while progressive farmers of a type suitable as competitors entered freely in numbers sufficient to bring about the success of the competition as an instructive enterprise. Twenty-seven entries were received. Six of these were rejected in the preliminary stage because the management of the farms they represented did not conform with the rules of the competition, and unexpected developments led to three competitors dropping out during the course of the competition. Hence the work on eighteen farms were considered in finally making the awards.

The winning competitors were :—

1st : A. J. Baxter, Aorangi, Feilding	£25 cash and Cup.
2nd : H. L. Knudsen, Tiritea, Palmerston North	£15 cash.
3rd : H. V. Benge, Feilding	£5 cash.

SUMMARIZED DATA ON COMPETING FARMS.

The following facts indicate the scope, nature, and returns of the competing farms :—

Average size of farm	86·5 acres.
Largest farm	201 acres.
Smallest farm	30 acres.
Average size of herd	51 cows.
Largest herd	85 cows.
Smallest herd	26 cows.
Average production of herds	264 lb. butterfat per cow.
Highest production of herd	333 lb. butterfat per cow.
Lowest production of herd	184 lb. butterfat per cow.
Average production of butterfat per acre	164 lb. butterfat.
Highest production of butterfat per acre	285 lb. butterfat.
Lowest production of butterfat per acre	70 lb. butterfat.
Average valuation	£56 per acre.
Highest valuation	£85 per acre.
Lowest valuation	£20 per acre.
Average cost of producing 1 lb. of butterfat	11·3d.
Lowest cost of producing 1 lb. butterfat	9·3d.
Highest cost of producing 1 lb. butterfat	15·6d.
Average cost of land (at 6 per cent. interest) to produce 1 lb. of butterfat	5d.
Lowest cost of land to produce 1 lb. of butterfat	3·6d.
Highest cost of land to produce 1 lb. butterfat	6·3d.

Two farms carried a substantial number of sheep, which so reacted on returns as to make it advisable to exclude these farms in a study of the dairying results. Therefore the figures in the foregoing table relative to the average production of butterfat per acre and the average cost of butterfat cover sixteen farms only.

Comment on General Results.

The general figures possess several interesting features. The herd average of 264 lb. butterfat to many may not seem as good as might reasonably be expected in a competition of this nature. However, it cannot be compared with herd averages as commonly referred to in connection with herd-testing association results. The competition herd-average was computed as far as possible on the basis of the number of cows in the herd irrespective of whether these were milked or not, considered in conjunction with the butterfat actually sold. The Dominion average for the season 1930–31 was 201 lb. per cow, covering all dairy cows in milk or dry. The latter figure covers not only factory returns, but family consumption of milk and cream, together with new milk fed to calves and wastage in separation. Hence the competition average is more superior to the best recorded Dominion average than the figures given suggest. The average of 164 lb. per acre compares very favourably with the Dominion average of somewhat less than 80 lb., according to the Farm Economist's figures, brought up to date last year.

While the average butterfat production in the district covered by the competition has not been ascertained accurately, it is safe to say that it is at least 40 lb. per acre less than the per-acre average of 164 lb. achieved by the farms in the competition. This gives particular significance to the fact that the cost of land, on a 6-per-cent. interest basis, in the competing farms amounted to 5d. per pound of butterfat. This means that if the well-known share-milking basis of one-third for land, one-third for labour, and one-third for all other expenses were correct, then in the case of the farms participating in the competition the cost of land was too high. On the figures already given this land was used to better effect that is usually the case, so that on the average the cost of land is still more excessive than it was in the competition. The remedy seems to be either lower land-values or lower interest and rent charges, or both.

Methods of obtaining required Data.

The items of information used in making the awards fall broadly into four groups: (1) Farm receipts and payments; (2) values of land, stock, and equipment, &c.; (3) allowances for wages, interest, depreciation, &c., in regard to which often no payments were made by the competitors; (4) farm practice, inclusive of both methods and results.

Farm Receipts and Payments.

The competitors were required to submit at the close of the competition a statement of transactions which they could support by documents, and this statement, plus allowances, referred to later, provided the information necessary to arrive at each farmer's

financial results. In order that the competitors might be in a position to supply the required statement without leading to undue difficulty in its preparation or checking, competitors were asked at the outset to make all farm payments by cheque and to bank all farm moneys received. Most of them were already doing this.

Incidentally, the domestic expenditure of the competitors was not considered, and information regarding interest payments, rents, and mortgages of any kind was not required. Allowances based where appropriate on valuations, as will be explained, served to cover such matters. In addition, the competitors were required to keep all dockets and documents relating to sales and purchases—for example, sales of pigs, calves, &c. To assist the competitors further a fairly exhaustive list of possible items of expenditure and income which should be noted was supplied to them.

It is recognized that this system of securing a statement of payments and receipts is not perfectly free from danger of misrepresentation. For instance, a competitor could sell some one else's butterfat or pigs in his own name. But it would be difficult to eliminate completely the possibility of this type of fraud in any system of recording accounts. It seems that in any system the competitor's honesty must be trusted to some extent. Incidentally, the judges' knowledge of the individual farms, gained from the several visits and their knowledge of farming generally, does not make misrepresentation easy.

VALUATIONS.

Government valuations and owners' payments or valuations in respect to land, equipment, &c., were all considered unsatisfactory for the purposes of the competition, for which it was decided to have valuations made specifically. The work of valuation was undertaken gratuitously by two well-known local farm valuers, Messrs. David Collis and Oscar Monrad.

They adopted a standard of land prices which ranged slightly lower than would be asked by the owners from prospective purchasers and higher than would be accepted for loan purposes, thereby closely approximating the true commercial values at that time.

Herd values were based on a standard value of £12 per head for a sound mature cow of good average dairy type, ranging downwards from this figure according to age and quality. When pedigree animals came under consideration special pedigree values were not recognized.

All pigs and dry young developing cattle were valued at the beginning and again at the end of the period covered by the competition. This enabled the competitors to be given appropriate financial recognition for the amount of care, feed, &c., given such stock, and resulted in the appearance among items of farm income of entries reading "increase in value of young female stock" or "decrease in value of pigs on hand," &c.

Reserves of feed, such as hay, silage, and roots, were similarly valued at the beginning and the end of the period covered by the competition, the standard values used being hay £3, silage £1, and

roots 10s. per ton. As the result of such valuation, if a competitor finished the year with 5 tons less hay and 7 tons less silage than he had at the beginning, then, among the items of expenditure appearing in his statement would be "Decrease in value of fodder on hand, £17." Thus proper adjustment was made in those cases where entrants during the competition period operated on the results of previous effort.

ALLOWANCES.

The following allowances were made in determining the cost of production:—

(1) Interest at the rate of 6 per cent. on the value of land, stock, and equipment.

(2) Depreciation at the rate of 16⅔ per cent. on all mature cattle—that is, on the basis of six years' producing-life.

(3) Depreciation at standard rates on equipment, estimated at 10 per cent. on farm implements and 5 per cent. on milking-plant.

(4) Labour, even if not paid for, as in the case of sons working for their parents, at a minimum of £2 a week including keep, and actual rates if higher than minimum. Labour of the farmer-owner was charged at £2 10s. a week. This allowance is intended to cover merely the farmer's wages for his manual labour. It was assumed he would be to some extent more industrious and skilful than hired labour, hence the allowance of an extra 10s. a week. It remained for the reward for his mental labour to come from (*a*) his profits, and (*b*) interest (already provided for) on his equity in the property. In short, the farmer-owner was considered in a dual role—(*a*) as a labourer for whom wages must be allowed, (*b*) as an owner relying for reward upon interest and profits.

FARM PRACTICE—METHODS AND RESULTS.

Data in regard to farm practice and results were obtained by the judging committee in the course of its three visits. It was possible to check the principal item---that of butterfat production —by reference to factory returns.

Individual Financial Results.

From the beginning competitors were assured that information supplied by them would be treated as confidential. There has been a number of requests for detailed information about the individual farms, but it is obvious from the confidential nature of such information that it cannot be supplied. Even if there were no obligation to treat as confidential the information received from competitors, it is questionable whether it would be of much service to the general public to publish much of the information desired, especially that relative to finance; usually bald statements of accounts without a knowledge of the specific circumstances attaching to such statements are not altogether satisfactory.

The accompanying condensed statements of the year's financial results on three typical competing farms illustrate how different types of management were reflected in the ultimate returns:—

Farm A.—42 acres at £85 per acre; 36 cows; 11,997 lb. butterfat; average fat per acre, 285 lb.; average fat per cow, 333 lb.

Expenditure—	£	s.	d.
Interest on property	251	14	11
Depreciation on stock	70	3	4
Interest and depreciation on implements	12	0	0
Outgoing and depreciation on milking-plant	14	8	0
Insurance	1	9	2
Rates	20	4	3
Horse charges	4	14	0
Seed and manure	2	6	8
Hired labour	117	8	0
Owner's labour	130	0	0
Decrease in value of fodder on hand	7	0	0
Pig purchases	8	2	0
	639	10	4
Miscellaneous income—			
Calves	7	19	6
Skins	0	7	0
Pigs	56	0	1
Increase in value of pigs on hand	6	5	0
Increase in value of young female stock	23	0	0
	93	11	7
Summary—			
Expenditure	639	10	4
Less Miscellaneous income	93	11	7
Cost of 11,997 lb. butterfat	545	18	9
Cost of 1 lb. butterfat	11d.		

Farm B.—113 acres at £42 10s. per acre; 51 cows; 15,417 lb. butterfat; average fat per acre, 136 lb.; average fat per cow, 302 lb.

Expenditure—	£	s.	d.
Interest on land and stock	338	15	10
Depreciation on dairy stock	103	13	4
Interest and depreciation on implements	25	0	0
Outgoing and depreciation on milking-plant	20	8	0
Power	27	0	9
Insurance	3	8	10
Workers' insurance	1	6	0
Rates	18	4	9
Manure	40	11	11
Seed	11	4	0
Labour	111	0	0
Owner's labour	130	0	0
Pig purchases	12	12	0
Decrease in value of pigs on hand	49	5	0
	892	10	5
Miscellaneous income—			
Pigs	126	6	4
Poultry and eggs	5	0	0
Increase in value of fodder on hand	28	0	0
Increase in value of young female stock	95	0	0
Sheep returns	11	12	0
	265	18	4
Summary—			
Expenditure	892	10	5
Less Miscellaneous income	265	18	4
Cost of 15,417 lb. butterfat	626	12	1
Cost of 1 lb. butterfat	9·7d.		

Farm C.—79⅝ acres at £45 per acre; 30 cows; 8,738 lb. butterfat; average fat per acre, 110 lb.; average fat per cow, 291 lb.

	£	s.	d.
Expenditure—			
Interest on property	245	2	5
Depreciation on stock	58	3	4
Interest and depreciation on implements	13	10	0
Outgoing and depreciation on plant	12	0	0
Rates, taxes, &c.	24	10	1
Power	16	17	4
Manure	38	18	0
Seed and hire of team for special cropping	11	3	9
Veterinary medicine and attention	19	18	7
Stock-feed	14	18	4
Pig purchases	28	1	6
Hired labour	6	18	0
Owner's labour	130	0	0
Decrease in value of pigs on hand	3	12	0
	623	13	4
Miscellaneous income—			
Calves	2	18	0
Pigs	51	18	5
Poultry	39	18	2
Increased value of fodder	10	10	0
Increased value of young female stock	65	10	0
	170	14	7
Summary—			
Expenditure	623	13	4
Less Miscellaneous income	170	14	7
Cost of 8,938 lb. butterfat	452	18	9
Cost of 1 lb. butterfat	12·4d.		

Differences in Typical Farms.

In the competition Farm A excelled the others in per-acre production and herd average of butterfat. In view of the per-acre production it is naturally a highly fertile farm, since there was no outlay on fertilizers.

In comparison Farm B consists of land of much lower quality. On Farm A £85 worth of land yields 285 lb. butterfat, while on Farm B £85 worth of land yields 272 lb. butterfat, and when the fertilizers used on Farm B are taken into account the cost of land in the butterfat production of Farm B is substantially greater than in Farm A. Nevertheless, Farm B produces butterfat at a price substantially lower than Farm A mainly because—

(1) One labour unit produces 7,400 lb. of butterfat on Farm B, against 6,000 lb. on Farm A.

(2) The increased value of the young female stock on Farm B approximates the depreciation allowed on the mature animals, whereas in Farm A it falls far short of doing so. In Farm B herd wastage is eliminated by the growing of young females, while on Farm A it is not.

(3) On Farm A during the year of the competition feed reserves were depleted to the extent of £7 value, while on Farm B they were built up to the extent of £28.

The most substantial differences between Farm B and Farm C lie in the following facts:—

(1) The land is at approximately the same value in each farm; Farm B secures 136 lb of butterfat per acre, against 110 lb. per acre in Farm C.

(2) Pigs to utilize by-products are reared on Farm B and purchased on Farm C.

(3) Several charges, such as manure, stock-feed, and veterinary attention, bear relatively heavily on Farm C.

These comparisons illustrate how various practices affected the financial returns of the competing farms.

Practices associated with Successful Results.

In the competition major matters of management which came into prominence because of the consistency with which they were associated with attractive financial returns were (1) feeding of dairy stock in a more efficient manner than is normally carried out; (2) rearing of good young females in sufficient numbers to repair herd wastage and provide for expected expansion; (3) more than usually thorough utilization of dairy by-products by the exploitation of such sidelines as pig-rearing.

Better Feeding the Outstanding Feature.

The competition strikingly directs attention to the potentialities for increased profitable production to be found in the better feeding of our present stock. The most successful farms in the competition were those which gave most thorough attention to the good feeding of their stock all the year round along lines which are generally accepted as efficient. Particular attention was paid to the provision of ample supplies of suitable feed for use in the winter and early spring period, when the nutriment directly available from pastures is likely to be inadequate. On the whole, and particularly by the prizewinning competitors, the provision made for late summer feeding of dairy cows was better than is generally made.

The results obtained by the winner of the first prize exemplify particularly well how good winter feeding was reflected during the early part of the season in the butterfat returns. The daily production in August was approximately twice as good on the winning farm as it was on the farms of the district generally. In the district generally for every 100 lb. of butterfat produced in December only 35 lb. was produced in August, while on the first-prize farm over 68 lb. of butterfat was produced in August for every 100 lb. produced in December.

The good early start in production on the winning farm is reflected substantially in returns during the remainder of the spring and early summer, with the result that the average daily production during September, October, and November is very nearly as high as that for December, which is generally the flush period of butterfat production. To realize the full significance of this, it is necessary to bear in mind that practically all farmers—bad as well as good—secure high production in the season of plenty of feed, and hence the test of the

efficiency of a dairy-farmer's system of feeding becomes a comparison of the production during the low-growth periods and that of the rapid-growth periods. It is when this test is applied that the performance of the winning farm during spring and early summer is seen to be outstanding. *Prior to December the winning farm produced 377 lb. of butterfat for every 100 lb. produced in December, whereas the farms of the district generally produced only 296 lb. prior to December for every 100 lb. produced in December.*

From this it may be deduced that had farmers of the district generally produced as well relatively in the early part of the season as did the winner their production up to the end of December would have been 28 per cent. greater. The figures for the district generally are based on the factory returns of approximately 45,000 cows.

Relatively early calving was partly responsible for the comparatively good production secured in the early part of the season on the winning farm, but early calving generally proves futile unless the stock have the comparatively good condition and the strength which can be secured only by adequate suitable feeding during winter and early spring.

The main features of the feed provision on the farms which obtained good results were—

(1) Seasons of feed scarcity were avoided.

(2) At the different seasons the feed provided was suited in quality or character to the needs of the stock—for example, well balanced, highly digestible feed was provided in the latter part of the summer, whereas on many farms at this period plenty of feed, but of unsuitable type, is provided.

(3) Wastage of feed during periods of rapid growth of pastures was largely avoided.

The feeding system practised by the successful competitors led not to phenomenally good average yields of dairy stock, but to the carrying of more than the average number of stock, the butterfat production of which, while not outstanding, was well above the average of the district generally. From this it is not correct to infer that herds of exceptionally high production are not desirable. It is correct only to infer that such herds are not always handled in an economical way—the weakness is in respect not to such herds themselves, but to their occasional management.

Measures giving Good Feed Provision.

The comparatively good feed provision throughout the year was secured principally by the following means :—

Controlled Grazing.—On some of the competing farms there was considerable room for improvement in grazing management. On the other hand, there were several competitors whose grazing methods did not leave much scope for adverse criticism. These practised a relatively simple system of controlled grazing which results in leafy actively growing pastures at periods when many pastures are stemmy or dormant. This system differs in points of vital practical importance from what has been called a new system of intensive rotational

grazing brought, in recent years, to the notice of New Zealand farmers by information emanating from Britain and Germany.

The New Zealand system which has proved successful on farms in this competition and on other farms in the district calls for alternate periods of "spelling" and of relatively heavy stocking of pastures. In these matters it is similar to the European system, from which, however, it differs in the following important respects: (1) It does not call for the periodical specially close grazing which seems to be insisted on by advocates of the European system, and which apparently results necessarily in undesirable punishing of both pastures and stock; (2) it does not necessitate the used of a considerable number of "followers" consisting of store stock, which ordinarily are available only in comparatively small numbers on typical dairy-farms; (3) it does not demand a comparatively large number of unusually small paddocks; the farm awarded first prize consisted of fifteen paddocks totalling 90½ acres, and some other competing farms the returns of which were prominent were somewhat less subdivided.

Top-dressing.—The amount of top-dressing carried out by the competitors generally was somewhat scant in comparison with the practice in some other dairying districts, and probably increased top-dressing by many of the competitors would have yielded substantial profits. The amount of top-dressing material applied by the prizewinners was appreciably higher than that applied in the district generally, and averaged in cost the sum of 17s. for each cow milked.

Ensilage.—Ensilage was the main measure adopted by the successful competitors for the purpose of utilizing effectively any excess feed available in the season of rapid growth of grassland. On the prizewinning farms the employment of ensilage did not lead to the complete elimination of hay, which was made when suitable weather prevailed. Ensilage was of particular value in handling the early-season growth of the lucerne areas—growth which became available in uncertain haymaking weather and when green feed was not required to supplement the feed obtainable from the pastures. In addition to the three prizewinners, all but three of the remaining competitors practised ensilage, and two of these three expressed their intention of adopting it in the future.

Lucerne Culture.—Lucerne came into prominence in the competition because it occupied an important place in the feed provision on the farms of the three prizewinners. It was used variously as green feed for the dry late-summer period, as a source of hay when weather favoured haymaking, and of silage at other periods. By turning the growth of the early part of the season into silage virtually another "cut" is obtained each season, for otherwise the first cut is often removed relatively late in an endeavour to obtain weather suitable for haymaking.

The lucerne culture practised by the prizewinners was simple and relatively inexpensive. Phosphatic top-dressing was carried out fairly liberally; the first cut of the season was removed at an early stage for ensilage, and so the shading effect of any weeds which outgrew the lucerne during the cold season was minimized; the

amount of cultivation carried out was not considerable, and grazing of the lucerne was avoided as much as possible.

Special Arable Crops.—The advisability of totally discarding the use of the plough in dairying, and of depending for feed upon pastures alone, is at time seriously discussed in the district covered by the competition. In view of this, it is specially interesting that arable crops were prominent in the competition. Firstly, they played an important role on the farms awarded the prizes, and, secondly, they were grown by sixteen out of eighteen competitors. The mangel was the most popular for winter use, and the soft turnip, used either alone or as a companion to green lucerne, was favoured for use in the dry summer period. The soft turnip serves well in place of lucerne should there be an interval during the dry period in which suitable green lucerne is not available, and if for any reason the lucerne becomes too stemmy and indigestible to give the best results in butterfat production the use of soft turnips in conjunction is found to give more suitable feed. In winter the root and other arable crops were fed with good results not only to cattle, but also to pigs. Soft turnips alone were very useful for the summer period on farms without lucerne areas.

From the facts already given it is clear that the most successful competitors took special care to have an assured and adequate supply of reserve feed comprised of hay, silage, and special forage crops for use both in summer and winter. In view of the varied sources of supply only an extremely abnormal season would have caused a feed shortage during the customary critical periods when feed reserves are required.

Repairing Herd Wastage.

The competitors generally, and especially those who were awarded prizes, took effective steps to repair normal herd wastage and in many instances to allow also of future herd expansion. The three prizewinning farms considered together raised young females (yearlings and springers) at the rate of sixty for every hundred cows milked. For purpose of comparison, interest attaches to the fact that in a recent farm survey embracing Taranaki and Auckland dairying it was found that forty-three young females were being carried for every one hundred cows milked.

Taking into account all competitors the provision for herd maintenance is summarized in the following data: Twelve of the competitors, after providing for the replacement of a sixth of the herd each year, were in credit a total of £590, approximately £50 each, from young females raised; the highest credit was £107 and the lowest £11. Four, after making a similar allowance for herd replacement, were a total of £100 in debit respecting young stock, an average of £25 each, the highest being £40 and the lowest £12. One came out even. One, by miscellaneous buying and selling, clouded the issue, and was not considered.

In arriving at the above amounts the surplus young females available for sale, after making provision for herd replacement at the rate of one-sixth of the herd annually, were valued at £6 10s.

per head for springing heifers and £3 10s. a head for yearlings—in both cases for animals of good type and condition.

From these facts it may be concluded that progressive farmers generally on typical Manawatu dairying land look upon the raising of dairy heifers to meet their own requirements as economical. Though regular herd-testing each year under the association or group system was not favoured by the majority of competitors, the breeding of female stock generally was based on butterfat production data relative to both sire and dam.

Utilization of By-products in Sidelines.

The competition provided interesting evidence regarding the potentialities of sidelines. The prizewinners utilized skim-milk, together with lucerne and special annual crops, in such a way that their sidelines, apart from the provision for normal herd-wastage, were equivalent to approximately one slaughtered pig to every cow milked. The average for the Dominion is approximately one slaughtered pig to every three cows milked.

The main features of the pig-keeping practice of the successful competitors were (1) no purchasing of store pigs; (2) relatively wide grazing range; (3) no elaborate housing, although comfortable accommodation was available in severe weather; (4) use of very little purchased feed, winter feed being provided by crops grown on the farm.

On five of the competing farms poultry contributed fairly substantially to the returns. The data available from the competition were not sufficient to enable any definite conclusions to be formed, but they suggest the suitability of poultry, especially when efficient female or other light labour is available.

Importance of Farm Management.

The results of the competition emphasize strikingly the importance of management. The range in cost of butterfat production from approximately 9¼d. to 15½d. per pound on farms in respect to which there has been uniformity regarding valuation and estimation of financial returns, can be attributed almost wholly to differences in management. In short, it exemplifies well that modern dairy-farming calls not only for skill in carrying out various operations, but also for intelligence in deciding what operations are to be carried out.

General Conclusion.

The methods used and the results obtained in the competition are not considered as necessarily suitable bases upon which to found generalizations relative to sound dairying. In many matters even the most successful competitors were not satisfied that the methods they employed during the year of the competition were productive of the best possible returns. It is felt, however, that the competition served a very useful purpose in directing attention to farm practices which give substantially better results than those generally obtained under similar conditions.

MANURING OF EARLY POTATOES.

EXPERIMENTS AT PUKEKOHE IN 1931.

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EXPERIMENTS in the manuring of early potatoes at Pukekohe, Franklin County, were commenced in 1926. During the first three years it was established that bonedust, the then most popular fertilizer, could be replaced more profitably with superphosphate plus a quantity of sulphate of ammonia sufficient to balance the amount of nitrogen contained in the bonedust. In the following year, 1929, experiments were conducted to ascertain the value of sulphate of ammonia, sulphate of potash, and Diammonphos, and to find the best method of application of superphosphate. In 1930 these experiments were continued with slight modifications; also an attempt was made to find out the most suitable quantity of superphosphate to use and to test the value of nitrogen in different forms. (See *Journal* for April, 1930 and 1931.)

The conclusions arrived at by the end of 1930 were as follows:—

(1) Superphosphate is the most efficient phosphatic fertilizer.

(2) Nitrogen contained in Ammophos, Diammonphos, and sulphate of ammonia gave large increases in yields.

(3) Potash had proved of little value in increasing the yield.

(4) The fertilizer should be applied as close to the sets as possible.

(5) Growers were advised to use as the result of these experiments whichever of the following was the cheaper: (*a*) Superphosphate 12 cwt., plus sulphate of ammonia 4–6 cwt., per acre; (*b*) Diammonphos* 4–6 cwt. per acre; (*c*) Ammophos† 20/20 and Ammophos 13/48, 6–9 cwt., per acre, using half of each.

THE 1931 EXPERIMENTS.

Further investigations in manuring the early potato crop were carried out by four experiments on four farms on Pukekohe Hill in 1931. The season was not very favourable for the very early crops, the weather proving fairly cold and boisterous.

Except for the experiment conducted on W. Buttery's farm, each treatment consisted of twenty-eight to thirty replicated plots, each of which was a single row 1 chain in length. Rows next to ploughing feerings and finishes, and fences, were not included in any of the experiments. The Northern Star (Gamekeeper) variety was used in all four trials.

* Diammonphos contains about 20·5 per cent. of nitrogen and 52·5 per cent. of phosphate expressed as P_2O_5.

† Ammophos is sold in two grades—20/20, which indicates 20 per cent. of ammonia (= 16·5 per cent. nitrogen) and 20 per cent. P_2O_5; and 13/48, which indicates 13 per cent. ammonia (= 10·7 per cent. nitrogen) and 48 per cent. P_2O_5.

Trial on G. T. Nicholson's Farm.

This experiment was conducted on a field cropped the previous season with two crops of potatoes, after being in pasture for five years. The treatments were :—

(1) Superphosphate 15 cwt. (44/46 per cent. tricalcic phosphate*).
(2) Superphosphate 15 cwt., sulphate of potash 2 cwt.
(3) Superphosphate 15 cwt., sulphate of potash 2 cwt., sulphate of ammonia 4 cwt.
(4) Superphosphate 15 cwt., sulphate of ammonia 4 cwt.
(5) Superphosphate 15 cwt., sulphate of potash 4 cwt., sulphate of ammonia 4 cwt.

The plots were planted on 11th and 12th May, 1931, and were dug and weighed on 20th October. The trial was the same as conducted the previous year (1930), and almost similar to the trial carried out in 1929. Table 1 shows the results of the experiment in 1931.

Table 1.—Results in G. T. Nicholson's Trial.

Treatment per Acre.	Yield per Acre.			Increase of First-grade Potatoes over Treatment 1.	Net Value of Increase per Acre over Treatment 1.
	First Grade.	Second Grade.	Total.		
	Cwt.	Cwt.	Cwt.	Cwt.	£ s. d.
(1) Super 15 cwt.	104	15	119	..	..
(2) Super 15 cwt., sulphate of potash 2 cwt.	101½	15	116½	2½*	2 4 0†
(3) Super 15 cwt., sulphate of potash 2 cwt., sulphate of ammonia 4 cwt.	130½	15½	146	26½	3 18 0
(4) Super 15 cwt., sulphate of ammonia 4 cwt.	138	16½	154½	34	7 18 0
(5) Super 15 cwt., sulphate of potash 4 cwt., sulphate of ammonia 4 cwt.	135½	16	151½	31½	3 12 0

* Decrease. † Loss.

The rows treated with sulphate of ammonia were observed to grow more vigorously than the rows receiving none of this fertilizer. The last column in the table gives the per-acre value for the increased yield over Treatment 1, the value of the extra manure, extra bags, and cost of digging and carting being deducted from the gross value of the additional table potatoes. Also, since sulphate of ammonia is almost certain to increase the acidity of the soil, for every hundredweight of sulphate of ammonia used in each treatment 2s. has been subtracted as the estimated cost of liming to counteract the acidity. The first-grade potatoes sold for £8 per ton, a very low price for the time of the year.

In statistical treatment of the results presented in Table 1, the increase of Treatment 1 (super alone) over Treatment 2 (super and potash 2 cwt.) is not significant; the increase of Treatment 3 (super and potash 2 cwt. and sulphate of ammonia 4 cwt.) over Treatment 2 (super and potash 2 cwt.) is significant in first-grade and total yield; the increase of Treatment 4 (super and sulphate of ammonia 4 cwt.) over Treatment 1 (super alone) is significant in first-grade and total

* = 20·2 to 21·1 per cent. P_2O_5.

yield; Treatment 4 (super and sulphate of ammonia 4 cwt.) is significantly better than Treatment 3 (super and potash 2 cwt. and sulphate of ammonia 4 cwt.) in total yield, but is not significantly different from Treatment 5 (super and potash 4 cwt. and sulphate of ammonia 4 cwt.).

The use of potash has decreased the yield in each of the three comparisons, but only significantly so in one case in total yield. The use of sulphate of ammonia 4 cwt. has given the large increase of 1·7 tons per acre of table potatoes, or a net profit due to this fertilizer of £7 18s. per acre.

A survey of this experiment, which has been carried out now for three years, is shown in Table 2. The average yield for three years shows an increase of about 1 ton per acre of table potatoes, due to the use of 4 cwt. of sulphate of ammonia.

Table 2.—G. T. Nicholson's Trial over Three Years.

Treatment per Acre.	Average Yield per Acre of First-grade Potatoes.			
	1929.	1930.	1931.	Average.
	Tons.	Tons.	Tons.	Tons.
(1) Super 15 cwt.	4·6	6·4	5·2	5·4
(2) Super 15 cwt., potash 2 cwt.	4·38	6·7	5·1	5·39
(3) Super 15 cwt., potash 2 cwt., sulphate of ammonia 4 cwt.	5·32	7·6	6·5	6·47
(4) Super 15 cwt., sulphate of ammonia 4 cwt.	5·32	7·5	6·9	6·57

Treatment 5 was not included in the 1929 trials, and therefore is not shown in the above table.

Trial on P. A. Miller's Farm.

This trial was laid down on a field which was ploughed from a four-year lea in the autumn of 1930, on which two crops of potatoes were taken in the 1930–31 season. The experimental area was planted on 27th May, 1931, after a catch-crop of mustard for green manure. The treatments were as follows:—

(1) Superphosphate 15 cwt., sulphate of ammonia 4 cwt.
(2) Superphosphate 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.
(3) Superphosphate 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.

The manure of Treatments 1 and 2 was sown in a 3-in.-wide band, the fertilizer being distributed very close to the potato sets as they were planted in the furrows. In Treatment 3 the fertilizer was sown in a 9 in. – 12 in.-wide band, as is common practice. Germination counts were made on 13th August when the plants were well through the ground, but these did not show any significant differences in the number of misses in the various treatments. Therefore the close application of the fertilizers cannot be said to have affected the strike. In fact, the number of misses was greater in Treatment 3, where the fertilizers were distributed in a 9 in. – 12 in. band. At no time during growth could any differences be detected by observation.

The trial was dug and weighed on 28th October with the results shown in Table 3.

Table 3.—Results in P. A. Miller's Trial.

Treatment per Acre.	Yield per Acre.		
	First Grade.	Second Grade.	Total.
	Cwt.	Cwt.	Cwt.
(1) Super 15 cwt., sulphate of ammonia 4 cwt., in 3 in. band	90	16	106
(2) Super 15 cwt., sulphate of ammonia 4 cwt., potash 2 cwt., in 3 in. band	89½	16	105½
(3) Super 15 cwt., sulphate of ammonia 4 cwt., potash 2 cwt., in 9 in. – 12 in. band	86	15	101

The differences in yield were not significant. Although the difference between fertilizer in 9 in.–12 in. bands and 3 in. bands is not significant, the increase in favour of the latter has been consistent during the last three seasons. The difference was significant in season 1929, and amounted to 12·4 cwt. The use of 2 cwt. of potash has not given any increase in yield, which confirms the results in last season's trial on this farm.

Trial on E. J. Campbell's Farm.

The trial was carried out on a field broken up from a three-year-old pasture in the autumn of 1929. Two crops of potatoes were grown in the 1929–30 season, followed by two crops in the 1930–31 season. The field had only a poor turf to plough under in 1929. The experimental area was planted on 12th and 13th May, 1931. The experiment was laid down to further test the yield value of potash, and to discover the quantities of phosphates and nitrogen (sulphate of ammonia) most economical to apply. The manurial treatments per acre were as follows:—

(1) Superphosphate 14 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.
(2) Superphosphate 14 cwt., sulphate of ammonia 2 cwt.
(3) Superphosphate 14 cwt., sulphate of ammonia 4 cwt.
(4) Superphosphate 14 cwt., sulphate of ammonia 6 cwt.
(5) Superphosphate 11 cwt., sulphate of ammonia 6 cwt.
(6) Superphosphate 8 cwt., sulphate of ammonia 6 cwt.

The trial was weighed on 6th October, with the results shown in Table 4 (next page).

The first-grade potatoes were sold for £16 per ton. The addition of potash caused no significant increase in yield. Treatment 3 (super 14 cwt. and sulphate of ammonia 4 cwt.) is significantly superior in first grade and total yield to Treatment 2 (super 14 cwt. and sulphate of ammonia 2 cwt.), but Treatment 4 (super 14 cwt. and sulphate of ammonia 6 cwt.) is not significantly superior to Treatment 3 (super 14 cwt. and sulphate of ammonia 4 cwt.). A reduction of the amount of superphosphate from 14 cwt. to 8 cwt. per acre has not affected the yield to any significant extent.

Table 4.—Results in E. J. Campbell's Trial.

Treatment per Acre.	Yield per Acre.			Increase of First-grade Potatoes over Treatment 2.	Net Value of Increase per Acre over Treatment 2.
	First Grade.	Second Grade.	Total.		
	Cwt.	Cwt.	Cwt.	Cwt.	£ s. d.
(1) Super 14 cwt., sulphate of ammonia 4 cwt., potash 2 cwt.	47½	17½	65	7½	2 8 0
(2) Super 14 cwt., sulphate of ammonia 2 cwt.	40	16½	56½	..	..
(3) Super 14 cwt., sulphate of ammonia 4 cwt.	45½	17½	63	5½	2 13 0
(4) Super 14 cwt., sulphate of ammonia 6 cwt.	48	18	66	8	2 12 0
(5) Super 11 cwt., sulphate of ammonia 6 cwt.	49½	18	67½	9½	4 14 0
(6) Super 8 cwt., sulphate of ammonia 6 cwt.	46½	17½	64	6½	2 15 0

From a comparison of Treatments 1 and 3 it can be seen that, as in the two previous seasons' experiments on this farm, potash has not increased the yield significantly. The use of sulphate of ammonia has again given payable returns in spite of low prices for potatoes. The effect of diminishing the quantity of superphosphate used is on a par with the previous season's results. It would appear that the quantity of superphosphate can be fairly safely reduced to about 11 cwt. per acre.

Trial on W. Buttery's Farm.

The field selected for this experiment was skim-ploughed early in 1931 and disked during the autumn, and the potatoes in the experimental area were ploughed in on 12th and 13th May, 1931. The trial was laid down to further test the value of applications of potash under the usual method of broadcasting in the furrow, and also to test the value of predressings of potash. The treatments were as follows, all manure being applied in the rows with the sets, except where otherwise stated in the case of predressed potash :—

(1) Superphosphate 12 cwt., sulphate of ammonia 4 cwt.

(1*a*) Superphosphate 12 cwt., sulphate of ammonia 4 cwt., and predressing of sulphate of potash 4 cwt.

(2) Superphosphate 12 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.

(2*a*) Superphosphate 12 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt., and predressing of sulphate of potash 4 cwt.

(3) Superphosphate 12 cwt., sulphate of ammonia 4 cwt., sulphate of potash 4 cwt.

(3*a*) Superphosphate 12 cwt., sulphate of ammonia 4 cwt., sulphate of potash 4 cwt., and predressing of sulphate of potash 4 cwt.

The predressings of 4 cwt. of potash were applied on 8th April, over a month prior to the planting of the trial. The experiment was sown in two adjacent blocks. Each block consisted of six replications of the treatments sown with the seed, crossed by three

strips of potash predressing alternating with three strips without potash. The potash strips of one block were opposite the "no potash" strips of the other block. Thus there were eighteen replications of each treatment in each block, giving in all thirty-six replications.

During growth Treatment 1 was observed to be very slightly superior to Treatments 2 and 3. The potatoes were dug and weighed on 15th October. No differences were observed due to the predressings. Results from the weighings are shown in Table 5.

Table 5.—Results in W. Buttery's Trial.

Treatment per Acre.	Yield per Acre.		
	First Grade.	Second Grade.	Total.
	Cwt.	Cwt.	Cwt.
(1) Super 12 cwt., sulphate of ammonia 4 cwt. ..	84	22	106
(2) Super 12 cwt., sulphate of ammonia 4 cwt., potash 2 cwt.	82½	20	102½
(3) Super 12 cwt., sulphate of ammonia 4 cwt., potash 4 cwt.	77½	21	98½
(1*a*) Super 12 cwt., sulphate of ammonia 4 cwt., and potash 4 cwt. predressed	82	23	105
(2*a*) Super 12 cwt., sulphate of ammonia 4 cwt., potash 2 cwt., and potash 4 cwt. predressed	75½	21½	97
(3*a*) Super 12 cwt., sulphate of ammonia 4 cwt., potash 4 cwt., and potash 4 cwt. predressed	75	23	98

Treatment 1 (no potash) is significantly better than Treatment 3 (potash 4 cwt.) in first-grade potatoes. Treatment 1*a* (potash 4 cwt. predressed) is significantly better than Treatment 2*a* (potash 2 cwt. with seed and potash 4 cwt. predressed) and 3*a* (potash 4 cwt. with seed and potash 4 cwt. predressed) in first-grade potatoes. It can thus be seen that there are significant depressions due to the use of potash in the furrow, the normal method of applying it. All predressings of potash also caused depression in total yield and in yield of first-grade potatoes, but these are not significant.

Recommendations to Pukekohe Growers for Early Crops.

(1) Use 8 cwt. to 11 cwt. of superphosphate and 4 cwt. to 6 cwt. of sulphate of ammonia.

(2) Altogether nine trials have been carried out during the last three years to test the value of potash on the early crop. These trials have shown little value in the use of potash.

(3) Growers using sulphate of ammonia should certainly lime their land after the potato cropping is completed in the rotation. About 1½ cwt. of ordinary ground limestone is required for every hundredweight of sulphate of ammonia used.

The writer wishes to record his thanks to Messrs. Campbell, Nicholson, Miller, and Buttery for their helpful co-operation in carrying out the 1931 manurial experiments.

SOME DAIRYING POTENTIALITIES OF THE SMALL FARM PLAN.

Broadcast by the Department of Agriculture from Radio Station 2YA, Wellington, 31st May, 1932.

In the brief interval which has elapsed since the announcement by the Government of the Small Farm Plan abundant evidence has been provided that the intrinsic worth of the proposals is realized by thoughtful farmers. Every farmers' organization to which the plan has been explained clearly has expressed the opinion that it is at least better than any other scheme as yet submitted as a means of dealing with the present difficult economic situation. The opinion of prominent individual farmers is in conformity with that of their organizations. This has been well exemplified in the west coast area of Wellington Province and in the southern part of Hawke's Bay, where the services of several local advisory committees to co-operate with the Department of Agriculture were sought. Not a single refusal was received from the prominent busy men who were asked to give their services—services, by the way, which should be of great value in assuring the fullest possible success for the Small Farm Plan.

So far, so good. But it is evident that in some quarters there are misgivings about the amount of labour it is possible to absorb in an economic manner in our rural industries. Such misgivings seem usually to be based on the belief that, while additional utilization of labour would eventually be profitable, farmers to-day are not in a position to pay for additional labour from which profitable returns are to be expected only at some considerable distance in the future. Hence it seems well to consider whether there is not scope on our farms for the employment of additional labour from which practically immediate returns will be received. If it can be shown that there is such scope, then the grounds for the misgivings mentioned are correspondingly weakened.

For the present, consideration will be given only to that very important rural industry—dairying.

There is accumulated evidence that the actual milking of cows is not always done as efficiently as would be profitable, and that the commonest cause of inefficiency in this connection is scanty utilization of labour. The analysis of data secured through herd-testing and similar work has time and again pointed to the conclusion that many of the larger herds could with profit be split into two milking units. For example, herds of eighty and more cows are being milked on a share-milking basis. On the evidence available the owners of such herds would do well to explore the prospects of greater profits from the division of such large herds into two equal herds, employing two share-milking families in place of the one family under the present arrangement. Because of the extra labour that would become available thereby for such work as the growing of supplementary forage-crops and the conserving of surplus summer pasture growth, it is conceivable that the total number of cows in the two herds could be made greater than the number at present in the undivided large herd. It is to be

expected that the individual cows in the two herds would be more carefully and thoroughly milked than if they were all in a single herd.

Probably some owners of such large herds operated on a share-milking basis have at times considered the question of dividing their herds in the way just suggested, and, while realizing the advantages to be obtained, have been deterred from taking any action on account of the outlay involved in providing not only extra milking-plant, but also the necessary residence for the second share-milker. In many instances the outlay in this direction would bear more heavily to-day than formerly. Hence it is of particular importance that the Small Farm Plan in suitable circumstances may probably be employed to remove some of the financial difficulties that tend to arise in the dividing of undesirably large herds into two smaller more efficient ones. Farmers who are interested are therefore invited to consult the Small Farm District Organizers of the Department of Agriculture in regard to details which could not satisfactorily be discussed now.

In support of the view that the suggested division of large share-milking herds would prove profitable, there is the fact that an additional 600 lb. to 700 lb. of butterfat from each of two divided herds would be sufficient at current prices of dairy-produce to cover interest and depreciation on the milking-plant, to provide interest and sinking fund on the share-milker's house, and still leave a small amount on hand.

Another somewhat similar arrangement which would lead to increased efficiency in milking originates in the fact that practically all herds contain some cows which are difficult to milk or are otherwise unsuitable for milking by machines. It is considered that herd production would be materially increased by separating such animals from the main herd and hand-milking them as a separate herd-unit. It has been noted that herds of sixty to seventy cows at times contain from twelve to twenty animals which are difficult to handle on the machines—they often not only fail to produce to their best ability themselves, but hold up the progress of all the shed work. Such animals at times include some really good milkers. Experienced farmers generally believe that the best way of handling such cows is by a separate hand-milking arrangement. Yet this way is seldom adopted, because of difficulties of arranging the hand-milking. It is considered that a suitably located occupier of a Small Farm could at times be usefully employed part of his time to do the hand-milking on a share-milking or wage basis.

It would probably be difficult to overstress the importance of generally improving our milking efficiency. It is not merely a matter of obtaining greater direct production of butterfat from those animals which are difficult to milk out on the machines. That is really a minor matter in comparison with the effect improved milking would have on the incidence of udder troubles. In all important dairying countries udder troubles are a bane to the farmers, and in New Zealand experienced farmers and veterinarians are in hearty agreement in attributing this to a considerable extent to shortcomings in our machine-milking methods. For example, a qualified veterinarian operating in one of the most important dairying districts in the Dominion says definitely that much of the mammitis that comes under his notice would be avoided, or remedied, were the herds milked more

efficiently in the way that would be facilitated by the introduction of small hand-milking units attached to relatively large herds as already suggested. Hence those many dairy-farmers who rightly dread the ravages of udder disorders, should carefully consider the possibility of participating in the Small Farm Plan as a means of lessening the danger of avoidable losses from this cause.

There is a third important opening for the application of the Small Farm Plan to milking on farms the owners of which do not see their way to carry a full-sized dairy herd. There are, for instance, many sheep-farms or mixed farms on which dairy herds, say, of nine to fifteen cows, could be introduced with advantage, whereas herds of forty cows or more in number would be impracticable. There seems in such circumstances to be excellent openings for suitable small-holders settled in the vicinity to handle these small herds on a share-milking basis and do other available work besides.

The scope for utilizing the Small Farm Plan as a means of improving the general efficiency of the important work of milking is to some extent indicated by the fact that official statistics indicate there are some thousands of herds in the Dominion ranging over eighty cows in number. It may be said with confidence that to-day there is avoidable inefficiency in the milking of practically all these herds, and that in general more labour is the key to the avoidance of the inefficiency which costs our dairy industry very large sums annually in lost production.

Another dairying matter of even greater importance, and one in which the Small Farm Plan may be made to play a valuable role, is inefficiency in feeding practice. It has been demonstrated that thousands of our dairy-farmers do not feed their stock as well as would be profitable. Indeed, there is much evidence which points to the conclusion that by better feeding alone our dairy production could, within a single season, be increased by at least 20 per cent. It may truly be said, in fact, that the greatest and most urgent need of our dairying to-day is better feeding. Hence particular importance attaches to the fact that one of the most common causes of poor feeding is scant farm labour. Hundreds of dairy-farmers know that they are not feeding as efficiently as they should. They know also what they should do to increase profitably the efficiency of their feeding practice. But often they do not do what they realize they should do, because they cannot readily obtain the necessary labour.

Two of the more important measures which should more generally be adopted for the purpose of bringing about improved feeding in dairying are the growing of special crops, such as mangels, and the practice of ensilage. Both of these practices call for labour of the casual type, which could well be supplied by suitably located small-farm settlers. Within the next few weeks these practices will, on many farms, give occasion for such labour as the construction of ensilage pits or trenches, and the preparatory cultivation of land for suitable forage-crops.

In addition, better feeding is often dependent upon drainage and more fencing, which are at times not carried out because of paucity of farm labour.

In brief, paucity of casual farm labour often leads to failure to obtain increases in production which could be obtained not only profitably, but also promptly.

To sum up, the Small Farm Plan, if suitably employed, promises to assist materially in improving the efficiency of our dairying. This is possible because at present our dairying is inefficient in at least two important aspects. Firstly, there is considerable inefficiency in milking practice. Secondly, there is marked inefficiency in feeding practice. The inefficiency, both in feeding and in milking, may be attributed largely to unduly scant supplies of suitable readily available farm labour. The Small Farm Plan, if properly applied, offers a solution of the labour difficulties just considered.

Full information regarding the Small Farm Plan is available from District Organizers of the Department of Agriculture.

THE APIARIES ACT AND ITS PROVISIONS.

CONTROL OF DISEASE IN BEES.

E. A. EARP, Senior Apiary Instructor, Department of Agriculture.

THE notes which follow are presented with the object of outlining the main clauses of the Apiaries Act, and bringing them more prominently under the notice of all persons keeping bees. While the majority of beekeepers are, no doubt, aware of the provisions of the Act, it is probably safe to say that there are many who have never read them.

The Act was formulated on the principle that proper control by the State is best for the industry as a whole. It provides as far as practicable for the inspection of apiaries, and for the control of bee diseases and conditions which are likely to foster them. Past experience has proved that it is necessary for every beekeeper to do his part in controlling disease. Individual effort is largely nullified where it is counteracted by neglect on the part of others. Therefore the Act was framed to deal with the beekeepers who do not voluntarily treat diseased colonies. These will be found in practically every district. There are always careless or wilfully negligent persons in the community, and, as such individuals will not give their bees the necessary attention unless compelled to do so, legal means must be employed to see that the welfare of other beekeepers is safeguarded. When disease appears among the bees of the careless owner, and is allowed to remain untreated, such colonies are apt to become a menace to every other beekeeper in the neighbourhood.

The Act provides for the appointment of Inspectors to administer its regulations. These officers, however, do more than the Act specifies inasmuch as they act as Instructors also. A great deal of their time is taken up in educating beekeepers in the proper treatment of disease with regard both to season and method. Thus their scope is wide enough to include inspection for disease, treatment when it is discovered, instruction in general apiculture, and helpful advice in every branch of the honey industry.

It has long been recognized that the diseases of bees, besides being a serious matter to beekeepers, cause much loss to other members of the farming community. The honey-bee is perhaps the insect which accomplishes more than any other—the successful pollination of flowers so necessary for the proper production of fruit and seeds. It is an indispensable ally of the orchardist, gardener, and farmer. The beekeeper who gives his bees proper attention is a benefactor to his neighbours, since he fills gardens, orchards, and fields with willing workers; but, as he has no control over the flight of his bees, he must run the risk of their contracting infectious disease unless all the other beekeepers in the neighbourhood co-operate. Without efficient organization and a widespread knowledge of the destructive nature of the diseases affecting bees, it is difficult for even an efficient beekeeper to carry on successfully over a long period. He cannot take precautions against his neighbours' carelessness. His is a losing battle unless the State gives him legal protection.

The Apiaries Act, as its name suggests, aims at consolidating and amending the law relating to the industry in New Zealand. In addition to the machinery clauses, the Act provides for the compulsory registration of apiaries, forbids the keeping of bees in box hives, and compels the cure or destruction of all diseased bees and their hives. It also prohibits the removal of bees and appliances without a permit, treats the exposure of honey, wax, and materials from diseased hives as an offence, and requires beekeepers to notify the Inspector of the presence of disease within seven days after its discovery.

Section 5 of the Act deals with the registration of apiaries, and requires that no person shall keep bees except in an apiary registered under the Act. In addition, it makes any person keeping unregistered hives, or allowing them to be kept on his land, liable to a fine of £20. This compulsory registration provides the Inspector with a complete list of the beekeepers in his district—an immense help in carrying out inspectional work.

The provision that the keeping of bees in box hives is a breach of the law proclaims itself a wise measure. Only by providing the bees with movable combs can the beekeeper hope to keep a check on the condition of his colonies. Movable frames allow him to examine his hives easily, and to note at a glance the condition of brood, queen, and food-supply. No one can judge of these matters by merely looking at the entrances. Subclause (3) of this section is an important one, and should be known to every householder, as it provides for a penalty of £20 for allowing bees that may have become established in any other than a frame hive to remain after notice to remove them has been issued by an Inspector. Bees that have taken up their abode in houses, sheds, or other irregular shelters, must be removed or destroyed.

Another important section of the Act deals with the moving of bees and appliances from one location to another. No colonies may be removed without the written consent of an Inspector. This precaution is taken for the purpose of preventing the transfer of diseased bees to the neighbourhood of clean apiaries. Much harm has been done in the past by practices of this nature. Any beekeeper who moves colonies more than 10 chains without a permit, or fails to observe the conditions imposed by an Inspector, renders himself liable to a fine

of £25 on conviction of such an offence. The allowance of a range of 10 chains is mainly for the purpose of facilitating merely local readjustments of apiary-sites.

Section 8 of the Act requires the beekeeper in whose apiary disease appears to take proper steps to cure it and to prevent its spreading. He is also required to notify the Inspector in his district of its presence within seven days of the date on which he becomes aware of it. This latter regulation is also a wise precaution, inasmuch as it enables an Inspector to take immediate steps to control the disease and to prevent its spread to neighbouring beekeepers.

Section 9 deals with bees, honey, or appliances found to be diseased, and gives the Inspector authority to issue instructions as to their cure or destruction. The Inspector is also authorized to destroy any infected bees, honey, and appliances without notice if circumstances demand such action.

A further clause in the Act has reference to persons dealing in diseased bees and materials, or who expose honey, wax, combs, or appliances taken from infected hives or used in connection therewith, in such a manner that bees may gain access to such material. Until these materials have been thoroughly sterilized by approved methods they must be kept secure from the bees. Neglect of this precaution renders the offender liable to a fine of £50. No fine could be too heavy for this class of offender, for he may put a neighbouring beekeeper to endless trouble and expense through his negligence.

The foregoing are the main clauses of the Act which concern the beekeeper, and, while they make provision for inspection of bees by duly appointed Inspectors and compel treatment or destruction where disease is present, the work can be greatly assisted by every beekeeper becoming an inspector of his own bees. It is not sufficient to rely upon periodic visits from a Government Inspector to ensure that all is well with the bees. Seasonal examinations should be made, and whenever disease is found rigorous measures taken to combat it. The most serious disease, foul-brood, is such that any person of reasonable intelligence can usually detect it, and when there is any doubt on the matter an hour or two with an Inspector should be sufficient to give the beekeeper enough knowledge of the trouble and its management to ensure his success in eradicating it. Any person who is properly informed on up-to-date methods of beekeeping should be able to handle this disease.

The aim of the Department of Agriculture is to make every beekeeper competent to handle the everyday problems with which he is confronted. This it hopes to do, not by force, but by spreading useful knowledge wherever it is most needed. The Act provides the authority for dealing with the many important matters, and enables the Government to employ experienced officers to undertake any necessary enforcement. It is obvious, however, that the administration cannot hope to successfully cope with the immense amount of work—for financial reasons alone—without the reasonable co-operation of all owners of bees. The apiary officer of the Department is not a law enforcer until he is compelled to act as such, but is primarily an Instructor. It is preferable for all concerned that his services should be mainly utilized in the latter capacity.

STANDARDIZATION OF FRUIT-CASES.

Horticulture Division.

A FEW years ago the Canadian standard apple-case was adopted as the standard export case for New Zealand. So popular has this type of case become that there has been an increasing demand on the part of fruitgrowers generally for its adoption as the standard apple-package for local marketing purposes also. In giving effect to this demand, however, an altogether new range of cases must be devised.

In the first place, the principal object of the standardization of fruit-cases is to reduce the number of packages to the lowest possible number consistent with the safe carriage and efficient marketing of the different kinds of fruit, thereby lessening the worries of the grower, the sawmiller, and the buyer.

The points to be observed in effecting standardization include the convenience of stacking in ship, railway truck, &c., both as to the individual cases in a tier and also the length of tiers. Cases should be so designed as to definitely indicate how they should be stacked in a tier, or they should be square, thus making their stacking a matter of indifference, particularly when handled by inexperienced men. A proportion of cases that are nearly but not quite the same measurement each way are bound to be wrongly placed in a tier unless the position of stacking is indicated by a cleat such as applies to the export apple-case.

Although a number of cases of different capacity are necessary to meet the needs of the different kinds of fruit, they should be as far as practicable of a given length, so as to keep each tier uniform in this regard at least. The governing length in this instance is 19½ in.—the outside length of the Canadian standard case.

Specifications of Standard Packages for Fruit.

Kinds of Fruit which may be packed separately in the several Packages.	Dimensions in Inches, (inside Measurements).	Approximate Thickness of Timber in Inches.			
		Ends.	Sides.	Tops.	Bottoms.
Apples, lemons, oranges, or quinces	10½ × 11½ × 18	¾	5/16	¼	¼
Apples, lemons, oranges, or quinces	7¾ × 7¾ × 18	¾	5/16	5/16	5/16
Apples, apricots, nectarines, peaches, or plums	5¼ × 11½ × 18	¾	5/16	5/16	5/16
Apricots, nectarines, or peaches	2½ to 3½ × 11½ × 18	¾	5/16	5/16	5/16
Apricots, nectarines, peaches, pears, plums, or tomatoes	7 × 7 × 18	¾	5/16	5/16	5/16
Pears	4½ × 11½ × 18	¾	5/16	5/16	5/16
Pears	8½ × 11½ × 18	½	5/16	¼	½
Tomatoes	4½ × 7 × 18	½	¼	¼	¼
Tomatoes	4½ × 7 × 8½	½	¼	¼	¼
Cherries	3½ × 11½ × 14	½	¼	¼	¼
Cherries	5 × 10 × 11	½	¼	¼	¼

Again, there should be as great an interchange of timber as possible provided for between the sides, tops, and bottoms of individual cases as well as between the various cases of the set. As far as practicable all the foregoing points have been taken into account in designing the several cases that will appear in new regulations.

Although it is proposed to immediately standardize the range of cases shown in the accompanying table, the whole question will be brought before the next Dominion Fruitgrowers' Conference—not for the purpose of adding further types of case, but rather with the object of elimination so far as such may be considered advisable. The table gives details of the cases, as they will appear in the regulations, although possibly not in the same sequence.

DAIRY FACTORIES IN NEW ZEALAND, 1931-32.

THE following table presents the registrations of factories under the Dairy Industry Act as at 31st March last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1932, and the numbers of milk or cream suppliers to the factories during the same period :—

District.	Number of Factories.				Forwarded for Export, 1931–32.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
					Tons.	Tons.		
Auckland ..	63	36	4	103	67,737	14,886	22,186	1,476
Taranaki ..	19	67	36	122	10,905	36,060	3,029	3,928
Wellington ..	19	47	9	75	11,001	11,673	6,220	1,704
Hawke's Bay ..	9	17	1	27	4,359	3,556	4,318	741
Nelson	5	3	1	9	1,410	450	1,071	724
Marlborough ..	3	3	2	8	711	864	764	200
Westland ..	10	1	..	11	430	27	640	8
Canterbury ..	11	13	2	26	1,518	1,412	6,918	494
Otago and Southland	10	76	1	87	1,477	14,371	6,261	3,264
Totals, 1931–32	149	263	56	468	99,548	83,299	51,407	12,539
Totals, 1930–31	147	270	59	476	93,971	90,960	46,906	13,839

Whey butter was manufactured as a side-line at eighty-five of the above cheese-factories in 1931–32, the total quantity forwarded for export being 1,422 tons. This is not included in the total amount of 99,548 tons of butter given in the table, which refers to creamery butter only.

In the 1931–32 period there were also operating in the Dominion five milk-powder factories (two whole-milk and three skim-milk plants), seven casein-factories, two condensed-milk factories, and one sugar-of-milk factory.

—*Dairy Division.*

Oats for Ensilage.—A number of crops of oats were harvested for ensilage in the Okato district of Taranaki last November. The method adopted is to cut with the reaper-binder and stack in the same manner as a sheaf stack, leaving the bands intact. This results in a very fine ensilage, with a minimum of handling.

SEASONAL NOTES.

THE FARM.

Winter Work on the Grasslands.

On some farms on which pasture is the dominant crop the work carried out in the winter is mainly that of a stockman or a shepherd. On such farms the live-stock may be closely and carefully watched; they may be shifted from field to field at suitable intervals. But little else is done. Judged in the light of full knowledge of what constitutes modern grass-farming efficiency, such farms as a rule do not rank highly. The competent grass-farmer has usually good cause for being, in the winter, much more than a shepherd or a stockman.

Internal Fencing.

On a great number of farms additional internal fencing as a means to more effective utilization of the growth of pastures could with advantage be erected. While this statement is not intended as advocacy of the "pocket handkerchief" class of paddocks which some seem to consider desirable, it is intended as advocacy of the provision of a greater number of paddocks than exist on many farms to-day. On all grassland of medium to good quality the practice of extensive grazing should soon disappear. While definite rules suitable for application in specific cases cannot safely be stated, on account of variations in circumstances, it may be laid down that most average-sized farms of land of medium to good quality could with advantage be subdivided into at least twelve paddocks. And it is easy to conceive circumstances in which a somewhat greater number of paddocks on individual farms would be well justified.

Incidentally, it is not usually necessary or even desirable that the main grazing fields on any farm should be approximately equal in size. In dairying many of the internal fences may quite suitably be of a relatively simple inexpensive type. Fences consisting of three wires with four posts to the chain at times serve quite well. Such fences are especially appropriate when the suitability of the site of a fence is to any extent under trial. The erection of new fences frequently provides further winter work in the provision of suitable stock-drinking facilities in any new paddocks which have been formed.

Ensilage Measures.

In selecting the site of new fences attention should be paid to the present or future location of ensilage pits or trenches. The mere fact that ensilage is not practised on a farm at present is not good ground for ignoring the possibility that it will be introduced in the near future.

While thousands of farmers know from personal experience the value of ensilage, there are still many farms to which it could be introduced with profit. This is especially true of sheep-farms, but it is also widely true of dairy-farms.

Although the stack system of ensilage has certain distinct merits and should often be adopted if circumstances do not allow of the use of pits or trenches, the fact that the latter can be used effectively much more commonly than is sometimes believed gives special interest to the fact that ordinarily the pits or trenches are more economical in respect both to labour and to wastage of material than are stacks. Two of the main matters to be considered in the construction of pits and trenches are

convenience of location and the avoidance in the excavated space of corners, which militate against the very desirable thorough packing of the material. Much useful information about trenches and pits is available in this Department's Bulletin 146, "Ensilage on the Farm."

Grass Harrowing and Top-dressing.

Grass harrowing is a task which commonly calls for attention in July. It should be so carried out as to lead to thorough breaking-up and even distribution of accumulated droppings. To obtain this result most readily it is usually advisable to harrow the land twice in such a way that the direction of the second harrowing is at right angles to that of the first. A brush harrow or a width of chain harrow attached at the back of the grass harrow proper assists in thoroughly distributing the droppings.

In the past much very effective top-dressing has been carried out in July. In some respects such practice is not as effective as pre-winter top-dressing, but it has been so effective over wide areas that it may be recommended with confidence to those farmers who have carried out a scant amount of pre-winter top-dressing. When, as is often the case, the quickest possible results are desired from the application of phosphates, then normally superphosphate should be used. Careful and extensive investigation indicates that over wide areas the influence of superphosphate applied to grassland in July is to be detected within a few weeks, and so July top-dressing may be expected to increase not only the growth in summer, but also that in the latter part of spring, when the feed available for stock is frequently injuriously scant.

Drainage and Miscellaneous Pasture Work.

Apart from new drainage work in progress, there is need at times in July to do maintenance work in respect to existing drains, which at least should be inspected periodically to ascertain how they are functioning. The winter at times provides good opportunities for determining how future drainage work should be carried out; usually it is easier to obtain reliable information about the fall of the land, &c., when the land is in a waterlogged condition than when it is comparatively dry.

All possible steps should be taken to avoid trampling of wet, soft paddocks by stock in winter. Such trampling at times leads to substantial permanent damage to pastures. Damage arises not only because of the burial of valuable plants, but also because of the formation of bare patches of ground upon which persistent weeds, such as rushes, buttercups, and daisies, at times become established. When damage from trampling cannot be avoided it may be sound to concentrate it upon a worn-out pasture which it is proposed to put under the plough at no distant date for the purpose of eventually renewing it. When such a paddock is available winter feeding-out of hay, roots, &c., should be done on it as far as can be arranged conveniently.

Pastures which have been attacked by the grass-grub, if not so seriously damaged as to call for renewal, may advantageously have hay and roots fed out on them. At times the seeds in hay bring about a considerable amount of reseeding, and the trampling of the stock makes the position less favourable to the grubs.

It is as a rule advisable to clean up and spell certain paddocks in June and July in order that they may provide fresh suitable feed for the early part of the milking season. The paddocks so treated should preferably be well drained ones supporting a sward containing a good deal of rye-grass.

Crops auxiliary to Pasture.

Frequently the best returns possible from pastures are not obtained unless crops to serve as auxiliaries are suitably grown. One of the most important weaknesses in New Zealand farming lies in the fact that insufficient quantities of such crops are usually grown. Hence it is of particular current moment to remember that the crops other than grass which are to be grown during the coming season should be decided upon without any great further delay. Useful guidance regarding the cropping programme suited to supplement the pastures most profitably has been provided by the farmers' field-crop competitions, which have extended over many seasons and embraced a wide range of conditions.

These competitions provide conclusive evidence that on good average soils the mangel is not grown as extensively as it very profitably could be employed. During the three latest seasons in respect to which information is available the average yield of 244 crops which came under notice was 58 tons per acre. This result strikingly demonstrates the outstanding value of the mangel as a cheap source of winter feed. If hay is worth £3 a ton mangels are worth at least 10s. a ton, and on this basis a 58-ton crop of mangels is worth £29 an acre. It may with much truth be contended that the yield of the mangel as commonly grown is much nearer to 30 tons than to 60 tons per acre. But, as has been shown by the field competitions, there is no essential reason why farmers should continue to be satisfied with such low yields. It is known from extensive experience not only that success with the mangel is associated with good treatment, but also that early preparatory cultivation is an important component of this good treatment. As the mangel responds strikingly to all-round good treatment, the land devoted to it should be characterized by the highest possible fertility, whether natural or induced by manuring. Hence it is often advisable to dress liberally the future mangel area with any organic manure available from sheds, &c. When possible such organic manure should be applied before the land is ploughed. As preparatory cultivation for mangels should frequently be in progress in August, it follows that the distribution of the organic manure on the mangel area may at times well be undertaken in July.

The field competitions also demonstrated the potentialities under good management of the swede, which does not demand such high fertility as does the mangel; the average yield of 283 swede crops which came under notice in three recent seasons was 40 tons per acre. As a ton of swedes is approximately equal in feeding-value to a ton of mangels, a good average crop of swedes thus has a cash value of £20 per acre when the value of hay is fixed at £3 a ton—a return which surely suggests that in many localities swedes could with distinct profit be grown more widely. Particular importance attaches to the fact that a profitable swede crop may be the intermediate step to the improved permanent pastures obtainable by the use of seed mixtures containing appropriate quantities of true perennial ryegrass and good types of New Zealand white clover and cocksfoot.

Preparations for Lucerne.

Another very useful crop which has been much neglected and which warrants mention at this season is lucerne. If preparatory cultivation for lucerne is not already in progress it should be commenced at an early date. New Zealand experience simply confirms that of other countries by showing what a definite misconception it is to hold that lucerne is specially exacting in its requirements—a misconception so common that it is largely responsible for lucerne not being so widely exploited as is warranted by its intrinsic worth. It has been shown that lucerne can be grown profitably on practically all types of naturally well-drained soils.

Lucerne may well follow old pasture, and if this is done, then the land should be skim-ploughed well ahead of the time of seeding and subsequently ploughed deeply once only, so that weed seeds occurring in the surface layer may be covered with such a depth of soil that they will remain dormant, provided they are not by later cultivation brought back to the surface layer. Detailed guidance regarding lucerne management is available in this Department's Bulletin 155, "Lucerne on the Farm."

The results of the recent dry season should have served well to demonstrate the outstanding value of lucerne in districts which are subject to seasons of light summer rainfall.

Tillage for Spring-sown Cereals.

In general, in the latter part of June and in July seed-sowing should be avoided, but as spring oats and wheat are usually sown in August and September, and barley in September or early October, it is most advisable in June and July to make all possible progress with the tillage work in preparation for these cereals. In July, however, on heavy types of soil there is often so much water present that tillage would be injurious. Injury to the soil may be expected when the soil freely clings to boots or implements that pass over it, and when this happens cultivation, even though it is urgent, should be deferred. At times ploughing of old pastures may safely be carried out when ploughing of adjacent land which has been under cultivation recently would be injurious because of its wet condition. Ploughing of grassland should cease when the soil is so wet that furrows with a glazed-looking surface are produced. If land ploughed in the autumn has settled down firmly during the winter it should often be ploughed again in preparation for a spring-sown cereal.

Winter Feeding of Stock.

In general the regrettable shortage of winter feed which is commonly experienced year after year will be felt more acutely this winter than is usual. Hence it is worth noting that immature developing animals are likely to suffer more than mature stock. In the case of the developing dairy heifer, the direct result of inadequate winter rations may readily be a stunting of growth having a permanently harmful effect on yield. Hoggets also suffer severely from hard winter treatment. Hence it is usually profitable to give both of these classes of stock the best feed available.

The dairy cow should be treated so that she may be able to utilize the period when she is not being milked as a period of recuperation and renewal of bodily reserves, which are specially apt to be depleted in the case of heavy producers. If at all possible the feeding during winter of straw or of other inferior coarse feeds to all these types of stock should be avoided. It may be advisable, however, to maintain dry dairy cows on such coarse feeds if this is the only means of making available leafy grass or similar feed for the cows when they have calved.

The feeding of roots and silage together in considerable quantities should when possible be avoided. They are both relatively bulky, watery feeds, which tend to balance well with hay of good quality. Silage alone has been fed with definitely successful results right up to calving and lambing time, and it seems a moot point whether the results would have been better had some hay been used.

Cereals sown in the autumn should be fed off before the growth becomes markedly long; two feedings of relatively short growth are likely to be less wasteful and generally preferable.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Pruning.

PRUNING will be the chief occupation at present, and growers should keep it well in hand so that it may be completed before the spring work begins to pile up. Where it is necessary to make large saw-cuts they should be trimmed and covered with coal-tar or paint to prevent the entry of rotting and other fungi and to assist in the process of healing. Prunings should not be left about, but collected and burned. Many growers now use pruning sheets, from which the prunings are tipped into heaps for burning.

Grafting.

The limbs of trees it is intended to graft should now be cut back to within a foot or so of where it is intended to work them. Now is also the time to collect scions for grafting. Care should be taken in their selection, well-developed wood of the past season's growth which is not too thick—say, the thickness of an ordinary lead pencil—will be the most suitable. These scions should be placed in a shady place, covering fairly deeply but not so as to actually bury them.

Manures and Cover-crops.

Soils are made up of inorganic matter, the so-called inert materials (minerals), and organic matter, which is the product of decay of once living animals and plants. This latter is the humus of the soil, and in it is contained most of the nitrogen. Exhaustion of the soil may be caused by climatic conditions, improper cultural practices, leaching or washing out, and by continuous cropping with the same plant or class of plant. Excessive summer cultivation, especially in a hot dry climate, will destroy the organic matter in the soil and so dissipate the nitrogen content. Where agricultural crops are grown, a rational system of rotation helps considerably to conserve the necessary plant-foods. Fruit-trees essentially differ from other crops in various ways. They have a greater root area and therefore a wider range to forage in. On the other hand, there can be no rotation of cropping, as the trees occupy the ground for many years and are therefore making a demand on the same plant-foods in much the same proportion year by year.

It is not always safe to predict what manure a crop requires; indeed, whether it is a manure or some other treatment, such as more water, better cultural conditions, &c., which are necessary. Other things being equal, it may be taken that nitrogen is needed if the trees are making poor annual growth, especially terminal growth, and if the leaves are small and light in colour and the fruit small. In other words, if the tree looks starved and stunted nitrogen is probably deficient. Again, if the crops are poor in quality and quantity the cause may be traced to the lack of phosphoric acid or potash or both.

Those ingredients which are unduly removed by the crops are returned to the soil by the application of farmyard manure, green manures, or artificial manures. The available supplies of farmyard manure are, unfortunately, too limited for general application.

Green manuring or cover-cropping is the growing of crops essentially for the purpose of incorporating them with the soil. It is primarily practised to increase the humus or decayed vegetable matter in the surface soil. It also brings up plant-food which is more readily available when the crop decays, and is ploughed under, than it was in its original state in the soil. If a leguminous crop such as lupins, peas, beans, vetches, clover, &c., is utilized, a considerable amount of nitrogen is obtained free from the air. A soil well supplied with humus is a soil well supplied with

nitrogen. Humus itself holds stores of phosphoric acid and potash as well as nitrogen. During its decomposition it also liberates all plant-food to be made available for use. A considerable portion of the potash, lime, &c., used by plants is furnished in this way. Humus increases the absorptive and retentive powers of the soil with regard to moisture. Humus keeps the soil in a more equable temperature, warms it in winter and cools it in summer; it opens up stiff soils and binds light ones, and is a potent factor in the prevention of loss of manurial materials by drainage. The chief value of legumes over cereals is their capacity to obtain the most expensive manurial ingredient—nitrogen—free from the air by means of the nodules on the roots. They are, also, deeper rooting and are able to avail themselves of a food-supply from the lower soil which, as already explained, is brought up and made into a more available form for the use of the trees. The great need in many of our orchards to-day is the revitalizing of the soil by the turning in of leguminous crops.

Artificial fertilizers are materials that furnish, in a more or less available form, one or more of the three so-called essential elements of soil fertility—nitrogen, phosphoric acid, and potash. Fertilizers are used to supply these elements to the soil in a condition available, or nearly available, for the use of the plant, but must be used in conjunction with good tillage practice and the efficient supply of humus and moisture in the soil. The best way of supplying nitrogen is by turning in a leguminous crop and supplementing it with an application of sulphate of ammonia in spring and early summer. The amount per acre will vary, according to the needs of the tree, from 1½ lb. up to 4 lb. or 5 lb. per tree. Phosphoric acid is largely supplied in the form of superphosphate applied in autumn, winter, or very early spring, at rates varying from 2 lb. to 6 lb. and even more per tree, portion of which should be applied with the sowing of the green crop. The general form in which potash is added to the soil is in potash salts, muriate of potash, or sulphate of potash, the latter being usually given the preference, at the rate of 1 lb. to 3 lb. per tree; portion of this should also be applied with the green crop.

At present actual quantities per tree for the different classes of fruits in different districts cannot be stated. However, what little local experience there is available, together with the assistance of the Orchard Instructor for the district, will help very materially in selecting the right mixture.

Miscellaneous.

With the spring not far away, growers are urged to get their spraying plant in good working-order for the heavy calls to be made upon it during the coming season. A thorough cleaning and overhaul, with the renewal of worn-out parts, hoses, &c., is essential in order to avoid the heavy losses often sustained through break-down delays.

In the orchard nursery the ground should be kept free from weeds, and when the soil is in a fit condition a light hoeing will be beneficial.

Usually little is done in the way of working the ground in winter, but with the coming of spring everything should be renovated and made ready for the labour ahead.

—W. R. L. Williams, Orchard Instructor, Alexandra.

Citrus Culture.

It should not be necessary to remind growers to have everything in readiness to combat frosts where they occur during the late winter. Instructions were given in the May notes of last year. It will no doubt be contended by some that frost-fighting does not pay, but this is a very short-sighted view to take, and will not bear the light of common-sense business methods. Up to the present time a good deal of material and

labour will have been used in order to bring the fruit up to the marketable stage, and then, because it will cost an extra £10 or £20 to protect the crop, too often nothing is done. The frost may come and destroy only £20 worth of fruit, but the loss is in reality very much greater. The trees may and will suffer, and thereby affect the crop of the following season. There is, moreover, a likelihood of the loss becoming more extensive than this, owing to the fact that some growers often market fruit which has been slightly cut by the frost, and this will be reflected in the subsequent demand. It is well known that fruit damaged by frost loses most of its juice content, thereby making it of little or no value from a commercial viewpoint. Growers should always exercise great care in this regard and refrain from marketing any fruits that may be affected. However, the best course to follow is to prevent as far as possible any damage occurring by using frost-fighting appliances. Those who have made efforts in this direction have been well repaid.

Where new plantings are being carried out all preparatory work in connection therewith should be receiving attention.

Seasonal operations in the groves will consist in cleaning out drains, trimming shelter-belts, and harvesting of the fruit.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Mating-up the Breeders.

THE correct season for hatching and rearing young stock is now near at hand, and this implies the necessity for getting the birds mated up at an early date. To ensure a high proportion of fertile eggs containing strong germs the birds should be put together some time before eggs are required for hatching purposes. When pens are first mated up it frequently happens that the male bird will exhaust himself and it may be some weeks before he regains a condition in which to produce even a fair proportion of fertile eggs. This may cause the postponement of the hatching period, probably through the inability to secure a fresh male, or through other causes. It is always good policy to have a spare male as a standby.

Where large numbers of chicks of the heavier breeds are required, such as Orpingtons, Rocks, Wyandottes, &c., no time should now be lost in placing their eggs in the incubator. Where it is intended to bring out only a small number of chicks the hatching of the heavier breeds may be delayed until August. In the case of Leghorns and breeds of a similar type, it is best to hatch these towards the end of September. If profitable stock are to be produced, and the pullets are to lay during the following dear-egg season, the necessity for attention to every detail that will ensure having the full complement of chicks hatched out by the end of September, or early in October at the latest, cannot be too strongly emphasized. It is always better to be a month too early than a month too late. Chickens hatched late are always unsatisfactory, but with the present high cost of food they may easily mean a loss to the poultry-keeper.

Of late, fresh eggs have sold at high prices, and many producers have asked why their fowls have failed to lay. The answer is a simple one. Either the pullets have been hatched too early and have gone into a moult, or they have been hatched too late and will come into profit only when the egg-market is declining. It goes without saying that even stock brought out at the right time will not lay well, especially during the winter, if they are not fed and managed to the best advantage.

Points in Mating.

Mating birds with a view to increasing egg-production is without doubt the most important part of the poultry-keeper's work, because on the stock produced largely depend the profits to be made from his future flock. Fowls, like any other class of live-stock, can only be improved, or their existing good qualities maintained, by careful selection and breeding from fixed types of purebred stock. The chief objection to breeding from varied types, or crossbred birds, is that it invariably destroys fixity of type, and opens the door to reversion and the appearance of latent undesirable characters. It is therefore imperative that great care and judgment be exercised in choosing for the breeding-pen the best specimens possible.

In previous notes breeders were advised to select the required hens—the late moulters—or this season's breeding-pens before the moulting process set in, for it is then and only then that the best specimens for breeding can be determined. It is at that period of the year that certain signs manifest themselves in a striking manner whereby the good layer can be distinguished from the poor one. Usually at this period of the year the long-season layers, and naturally the late moulters, possess a more desired type and stronger constitutional vigour than the early moulters, and therefore it is from the late moulters that the breeding specimens should be selected. Where the timely advice was acted upon, and the late moulters and best breeding types were selected and marked accordingly—say, late in March—the work of mating will now be a simple matter. On the other hand, where the choosing of the breeding females has been left until the flock has moulted, the accurate selection of the most desirable hens will be found to be a matter of great difficulty. Indeed, in most cases it will be found an impossible task, as obviously when a flock has moulted and all birds are in a similar condition so far as their plumage is concerned it is impossible to distinguish between the early and late moulter, except, of course, where they have been specially marked to indicate this point. The poultry-keeper who has neglected to select his late moulters during the autumn may expect a high proportion of unprofitable stock as a consequence.

While lateness of moulting can be generally accepted as indicating good producing-power, it is not to be inferred that all late moulters are suitable specimens for the breeding-pen. Something more is required. If a heavy-producing strain is to be built up or maintained it is imperative for the poultry-keeper to have pictured in his mind a definite type, and to aim for this at all times. As before indicated, breeding from birds of mixed types merely because they possess good laying-points, or even an ancestral high egg-yielding performance, will never tend towards reaching the desired end. Sometimes birds of inferior type will prove good layers, but in a general way such stock have not the power to transmit their laying-qualities to their progeny, and are thus undesirable for the breeding-pen.

In making the final selection, even where the late moulters are concerned, every bird should be carefully examined in order to ensure that it is healthy and possesses undoubted constitutional vigour. No matter what other good points a bird possesses, whether it be male or female, if there is the slightest constitutional taint it should be rejected from the breeding-pen. Health and vigour form the base of all successful breeding-operations. Points indicating these essential requirements are a clean face free from wrinkles and feathers, clear, bright, prominent eyes, short shanks set wide apart, alert carriage, and tight glossy plumage, together with a well-developed crop. The question of size is another important matter. All birds conspicuously under or over the weight clauses specified in the New Zealand Utility Poultry Standard should be rejected. It is,

however, better to have a good big bird than a good small one. No matter how well they have laid, diminutive specimens of their breed should not be used for breeding. Such stock usually produce weedy progeny which yield only second-grade eggs. The small ones will come soon enough without specially breeding to secure them.

In mating fowls the aim should be not only to breed from those birds which lay the most eggs and which possess points indicating breeding-power; in addition, they should produce eggs of good marketable size—that is to say, of at least 2 oz. The production of small eggs is probably the greatest weakness in connection with present-day poultry-keeping. If any argument is required to prove that this contention is correct, it is surely borne out by the fact that in our export shipments of eggs those weighing less than 2 oz. have to be included in order to remove any surplus from the local market during the flush season of the year. The size of the egg can be increased only by careful breeding, and by the selection for breeding of only those birds that lay large eggs. In breeding to renew a laying flock pullets should not be used if it can be possibly avoided.

The Breeding Male.

It should be unnecessary to emphasize again the importance of choosing a sire of undoubted constitutional vigour, and that where eggs are the objective he should be descended from a strain of heavy layers. Feminine characters should be looked for in the female, but the sire should be practically the other extreme, though coarseness is not necessarily an indication of stamina. In addition, he should conform to the standard weight of the breed he represents. He should be active and of striking carriage. The other points in his make-up, such as a bold eye, clean face, broad back, legs well apart, and tight feathering, should be well enough understood—indeed, given the essentials first described, the minor points will necessarily follow.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

The Dormant Season.

DURING the months of June and July activities in the apiary, so far as the bees are concerned, should cease. No advantage is to be gained by interfering with the bees, providing the colonies have been left with ample stores, queen right, and well supplied with mats to conserve the heat of the cluster. After heavy rains it is advisable to remove the roofs to ascertain the conditions of the mats, and if any are found to be damp they should be removed. This can be done without disturbing the bees. Damp mats should not be tolerated, as they are harmful to the health of the bees at all seasons of the year, and more particularly during the winter months when dormant colony conditions obtain. As advised previously, a plentiful supply of mats should always be on hand.

Moving of Bees.

Providing sufficient care is taken, bees may be moved long distances with perfect safety at this season. It is not advisable to delay this work until the spring, as brood-rearing will then have commenced in earnest, and the numerical strength of the adult bees will be greater than at this period. Moreover, there is little brood in the hives to be injured. When moving bees short distances—say, up to a couple of miles—little preparation is necessary beyond screening the entrance with wire gauze, and fastening the bottom-boards and roofs with crate staples or battens. It is well to choose a cold night before closing the entrances of the hives to be removed. On arrival

at the new location the bees should be allowed to settle down prior to removing the gauze. It is quite a good plan to place some obstruction—a piece of board will suffice—in front of the entrance, as this will cause the bees to investigate and take new bearings. Some such action is necessary to prevent the field-bees from returning to the old location.

When removing bees long distances, which may necessitate their confinement to the hives for a lengthy period, it is essential that they be well packed so as to allow of ample ventilation. To safeguard against suffocation of the bees the hives require to have wire screens top and bottom. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions of a hive-body, and covering this with wire cloth. When placing the screens on the hives proceed as follows :—

The evening before removal, after the bees are all in, place a frame alongside each hive level-side up. Gently lift the hive on to the frame. Next remove the cover and mat, and place the upper frame level-side downward in position. The bees being now secure, the battens to hold the frames can be nailed on the following morning. Place a hive-cover over the frames in the event of rain falling during the night. When railing bees, the frames should run parallel with the truck, but with road transport the reverse is the case. This rule should be followed to prevent the frames from rocking and thus killing the bees.

It is well to remember that (as a precaution against the spread of disease) bees cannot be removed a distance of more than 10 chains without the written consent of an Apiary Inspector. Failure to obtain the necessary consent renders a person liable to a fine not exceeding £25.

The Winter Overhaul.

During the winter months, as opportunity offers, the working plant of the apiary should be carefully overhauled. The engine or motor, extractor, and tools require to be examined, and defective or broken parts replaced, so as to have all in readiness for next season's work. It is not wise to leave the repairing and painting of spare roofs, hives, and bottom-boards until they are required to be brought into use. Now is the best time to lay down future plans ; and if an increase in the number of colonies kept is decided upon, or the establishment of an out-apiary is being considered with the object of increasing income, no time should be lost in getting together the required number of extra hives, supers, roofs, and bottom-boards, also in the preparation of frames and the fitting of comb foundation.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

THE land for onions should now be clean and in fine condition. When sufficiently dry it can be rolled and given a dressing of fertilizers ; 5 cwt. of equal quantities of bonedust and superphosphate per acre, or 2 oz. to the square yard, harrowed in, will be found suitable in many instances. Mark out the rows 1 ft. apart and set out the plants from seed-beds sown down in the autumn. Shallots and garlic should also be planted ; and towards the end of July lettuce, cabbage, and cauliflower plants may be set out in many districts where growth has commenced.

As slugs are serious enemies of some of these crops, it will in some cases be advisable to destroy the pest shortly before planting by broadcasting a poison bait of Paris green and bran, 1 part to 28 parts by weight, mixed well and then made damp with water. It should be broadcast thinly towards the end of an afternoon. When slugs are seriously attacking established plants a

dusting with powdered alum during a moist evening when they are feeding will destroy them. Or the alum may be mixed with twice its weight of slaked lime.

At the same period, towards the end of July, the salad crops of mustard, cress, radish, and lettuce may be sown, also spinach and an early sowing of peas. In warm localities early potatoes may be planted, and in any case seed potatoes should now be given air and light ; this will steady the growth of the young shoots and cause them to make more thrifty growth when planted.

Soil that is deep, rich, moist, and sandy is the natural home of the edible asparagus, and any garden which can provide conditions approximating this specification should have a generous area devoted to this useful crop that is harvested when few other vegetables are available. Good plants for the purpose may be grown in twelve months if the seed is sown as soon as growth commences. Sow the seeds thinly, so that plants will stand 3 in. or 4 in. apart, covering them with about 2 in. of soil. The drills may be 18 in. apart, and wider if motor or horse implements are used for after-cultivation. Five pounds of fresh seed should provide sufficient plants for setting out an acre of land ; but as careful grading is recommended more seed should be planted to allow for culling all inferior plants and setting out only vigorous plants of good type. By sowing early such plants may be obtained for setting out a permanent plantation about the month of August, twelve months after sowing.

Established crops of spring cabbage and cauliflower will now benefit from a small dressing of nitrate of soda. If a little potash is also included with these spring dressings the results will often be better.

Where plantations of rhubarb are to be lifted for division and replanting in newly prepared ground the surplus roots may be forced now. The remainder should be cut up into pieces, each having one or two good buds, and planted with the crown about 2 in. beneath the surface ; 2½ ft. apart for the Linnæus varieties generally grown is sufficient. Shortly before planting, a soil dressing of an ounce or two of bonedust and superphosphate to the square yard should be made. Every opportunity offered by fine weather should be taken to complete the preparation of the land for other early crops to be sown during August.

Small-fruit Plantations.

An application of bordeaux spray shortly before growth commences should be made to all bushes and canes ; 8 lb. of bluestone, 6 lb. burnt rock lime, and 40 gallons water is a recipe that has given good results. Where small quantities only are required, 13 oz. bluestone, 10 oz. rock lime, and 4 gallons water may be used. To prevent the attack of bud-moth and other larvæ, arsenate of lead may be added, after it has been worked up into a cream and diluted. Two ounces of the paste or 1 oz. of arsenate of lead powder should be added to each 4 gallons of spray. Freshly made and thoroughly applied in dull weather without wind, good adhesion will be obtained with this spray with maximum efficiency.

Tomato Crops under Glass.

As soon as the first true leaf is out the seedling plants must be pricked out into boxes of fresh soil ; this should be a well-prepared compost of fresh loam with sufficient humus to retain moisture and sand to keep it open. If it is light a little bonedust may be added; but no other fertilizer should be used. Handle the plants carefully and set them deep almost up to the seed leaves, and firm the soil about the roots. Where transplanting is only done once, give them plenty of room 2 in. or 3 in. between the plants is the usual distance. When the box is planted, water well with tepid water through a fine sprinkler, and place the boxes back

on the hot-bed. Keep them rather close, and abstain from watering again until growth recommences; then air must be given on all suitable occasions, but cold draughts carefully avoided. A full measure of success depends chiefly on maintaining these conditions, so that sturdy growth is obtained without interruption.

In preparing the boxes for pricking out place a little strawy manure in the bottom, fill the box with soil and firm it well, giving special attention to the corners. The surface should be about ½ in. below the edge of the box. To facilitate the work and ensure uniformity, a marker made of a board with pegs at the required distance, may be used. The plants are then set at the right distance, and each box, if they are of uniform size —as they should be—will contain the same number of plants.

The Homestead Garden.

The present time is most suitable for any remodelling that may by necessary in the homestead garden. Many gardens could be greatly improved in appearance, or more economically managed, by carefully considered alterations at the present time. Each garden, of course, has its own special problems, but in some instances where specimen shrubs and trees or flower-beds have been rather too generously placed about a lawn, they may be removed and the soil made firm, the surface graded and neatly laid down with fresh turf. This not only secures the restful appearance of a wider unbroken lawn, but makes it much more easily managed. In the same way borders may be narrowed or reshaped.

The most common mistake in our designs is to rather overlook the necessity of a general classification of the main features. Too often the vegetable crops and fruit-trees, the shrubbery and the herbaceous crops are interplanted, with the result that they are neither profitable nor attractive. A little may be done in this way sometimes with satisfactory results; but in the main these are quite distinct departments, and a general recognition of this fact will greatly facilitate the working and increase production in our gardens. Land planted in fruit-trees of full growth and at the usual intervals is best given over entirely to them. One or two fruit or nut trees may sometimes be planted in a shrubbery, or as an isolated specimen on the lawn with good results. Lemons are often found growing quite happily under such conditions; but vegetable crops should have an open situation that is well-sheltered specially devoted to them.

The herbaceous flowering plants, annual or perennial, with a few exceptions, should also be given separate quarters, so that they may receive the special treatment they require. Such beds or borders may now be made or remade, for this is necessary every four years or so. Lift out the plants and heel them in in a piece of vacant ground in the kitchen garden, carefully affixing labels where necessary. Then trench the beds and borders, working in a generous dressing of manure in the bottom of the trench, and bonedust, &c., in the top spit. When it has all settled down replant with the material that has been heeled in. If this opportunity is taken to thoroughly clean the land, and to work out a good planting arrangement, the results are better and the further labour required is reduced to a minimum. This treatment should be given periodically.

—W. C. Hyde, Horticulturist, Wellington.

Prize Lucerne Hay.—The method used for curing the lucerne hay which won first prize at last year's National Dairy Show, Palmerston North, was as follows: The lucerne was cut, allowed to lie for two days, and then put into cocks 3 ft. to 4 ft. high. These were allowed to settle, then one cock was placed on top of its neighbour, so making a number of substantial cocks in the paddock. A cover was placed on top of each, and the lucerne was allowed to remain until thoroughly cured. It was then stacked.

WEATHER RECORDS: MAY, 1932.

Dominion Meteorological Office.

MAY was a dry and cool month for the Dominion as a whole. The first few days, however, were mild, and since most districts had experienced good rains there was fair growth of grass. Strong winds occurred on a few days only and sunshine was plentiful. The effects of the cold spells of the middle and latter end of the month, which were severe for the time of year, were therefore considerably mitigated.

Rainfall.—Over much the greater part of the country rainfall was 25 per cent. or more below the average. The northern portion of the Auckland Peninsula, scattered parts of the districts between Hawke's Bay and the Bay of Plenty, an area extending from both sides of Cook Strait through eastern Nelson and Marlborough to North Canterbury, and Stewart Island, however, had more than the average.

Temperature.—Except in the western portions of the South Island, temperatures were everywhere below normal, though the departures were not large. It is most probable that the low temperatures were due to the presence in the atmosphere of volcanic ash transported from the Chilean volcanoes which erupted on 10th April. Brilliant sunsets are reported from all parts of the Dominion. In the South Island frosts were numerous from the 10th onward, many of them being severe. The hardest occurred on the 25th, and on this occasion practically the whole of the country was affected. At the end of the month temperatures were again low.

Sunshine was considerably above the average at most stations.

Winds.—There was a preponderance of southerly wind, and, as is usual in such cases, the average velocity was light. A northerly gale blew in Taranaki and Wellington and the northern part of the South Island on the night of the 9th. On the 25th most places experienced a south-westerly gale.

Pressure Systems.—At the beginning of the month a depression had just crossed the northern portion of the North Island, and on the 1st and 2nd some heavy rains fell in eastern districts between Cook Strait and East Cape before the depression moved away. Fine weather was then the rule until the 9th. On that day a deep westerly depression was passing to the south of New Zealand, and on the next a cyclone centre developed in the northern portion of it. This centre was located to the west of the South Island, and it was not until the 14th that it passed finally away. Heavy rains fell over most of the South Island and in Taranaki on the 10th, accompanied in some cases by severe thunderstorms. In South Canterbury the total fall over two days over a considerable area exceeded 4 in., and there were high floods. A heavy snowfall occurred in the Mackenzie Country, a fall of 18 in. being recorded at Fairlie and the Hermitage. There were lighter falls also in Otago, while hailstorms occurred at coastal stations. The gale on the 10th has already been mentioned. The weather remained unsettled until the 15th, the area of heavy rains moving gradually northwards. On the 13th to 14th there were floods in Kaikoura. On the 12th the southern portion of the Auckland Province experienced thunderstorms and heavy rains.

On the 22nd another cyclone developed rapidly in the Tasman Sea. Rain was again almost general, with many heavy falls. This storm moved away fairly quickly, and was followed on the 24th by cold south-westerly winds. On the 25th the winds freshened to gale force and a bitter day was experienced. Hailstorms were widespread, and accompanied in some places by thunderstorms. Snow fell at many

places in the South Island and in the interior of the North. Tokaanu reported the heaviest snowfall seen in the district for ten years. The rest of the month was mainly fine, but the last day or two were very cold.

Westerly depressions were very poorly developed during the month.

RAINFALL FOR MAY, 1932, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	2·86	14	0·64	6·86
Russell	7·37	20	1·21	7·05
Whangarei	6·33	24	1·09	7·95
Auckland	3·35	17	0·75	4·66
Hamilton	3·93	13	1·26	4·72
Rotorua	5·40	9	1·80	5·72
Kawhia	3·39	13	0·88	5·42
New Plymouth	4·61	11	1·23	6·21
Riversdale, Inglewood	7·65	13	3·65	9·74
Whangamomona	5·72	6	1·87	6·88
Eltham	7·10	12	2·70	5·10
Tairua	3·98	14	1·50	7·26
Tauranga	4·36	11	1·38	5·15
Maraehako Station, Opotiki	5·90	8	2·56	5·63
Gisborne	2·21	15	0·89	5·42
Taupo	2·91	8	0·76	3·98
Napier	2·60	13	1·25	3·71
Hastings	2·49	10	1·59	3·33
Taihape	2·34	13	0·62	3·50
Masterton	3·64	16	1·15	4·02
Patea	3·15	10	1·03	4·19
Wanganui	2·57	12	0·51	3·36
Foxton	2·45	5	1·18	3·23
Wellington	7·79	14	1·73	3·98
South Island.				
Westport	6·59	16	1·34	8·35
Greymouth	4·64	11	1·03	8·08
Hokitika	4·37	11	1·12	9·71
Ross	5·03	9	1·28	10·05
Arthur's Pass	8·89	10	4·10	13·04
Okuru	3·56	5	1·64	11·09
Collingwood	6·89	9	2·88	8·99
Nelson	5·12	9	2·02	3·06
Spring Creek	4·77	6	1·35	2·95
Hanmer Springs	7·31	14	1·91	4·39
Highfield, Waiau	5·70	9	2·50	3·19
Gore Bay	4·98	10	1·51	3·31
Christchurch	1·29	12	0·76	2·53
Timaru	3·37	6	2·50	1·41
Lambrook Station, Fairlie	..	..	..	1·50
Benmore Station, Clearburn	1·03	9	0·42	1·81
Oamaru	2·33	5	0·84	1·59
Queenstown	1·30	10	0·38	2·57
Clyde	0·56	5	0·24	1·00
Dunedin	2·21	10	0·45	3·11
Wendon	1·49	8	0·34	2·02
Gore	1·84	16	0·30	2·56
Invercargill	3·41	21	0·48	4·34
Puysegur Point	5·37	24	0·75	6·74
Half-moon Bay	6·52	23	1·36	4·75

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1931–32.

A LIST of growers who have received provisional certificates in connection with the system of Government certification of seed potatoes in the past season is printed below.

Provisional certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed. Certification tags to be attached to the sacks are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes and is satisfied that they are still of the same standard of purity and freedom from disease as was indicated by the field inspection.

NOTE.—Lines entered under the name of the Government Pure Seed Station comprise relatively small areas of "selected" seed. Applications for this seed should be made to the Government Pure Seed Station, P.O. Box 4, Lincoln.

LIST OF GROWERS.

Name and Address.	Cropping-power in Tons per Acre.	Percentage of Foreign Varieties.	Acreage.
Aucklander Short-top :—			
Stafford, J., Springston	10·1	..	1
Oakley, W., R.M.D., Halkett	10·0	..	4
Crump, F., Springston	9·8	..	4
Government Pure Seed Station, Box 4, Lincoln	9·7	..	..
Jellie, J., Russley Road, Fendalton (line A)	9·7	..	2
McPhail, W. A., Mitcham, via Rakaia	9·7	..	3
Poulton, A. D., R.M.D., West Eyreton (line A)	9·7	1·0	4
Rich, A. J., R.M.D., Kaiapoi	9·7	..	20
Nairn, G., Lakeside	9·6	1·8	2
Roper, R. S., R.M.D., Halkett	9·6	0·5	3
Allison, J., R.M.D., Courtenay	9·5	..	2
Seyb, L., Washdyke, Timaru	9·5	..	1
Marshall, D., R.M.D., Leeston	9·4	1·5	10
Poulton, A. D., R.M.D., West Eyreton (line B)	9·4	..	2
Redmond, C., R.M.D., Kimberley	9·4	0·1	14
Eder, W., R.M.D., Sefton	9·3	..	14
Marshall, H. M., R.M.D., Weedon's	9·3	..	1
Martin, W. E., R.M.D., Kaiapoi	9·3	0·4	18
Pirie, J., Kingsdown, Timaru	9·3	..	1
Quigley, W., Doyleston	9·2	0·2	3
Swanston, W., Selwyn	9·2	0·8	4
Dyer, H., Southbrook, Rangiora	9·1	..	2
Guy, T. A., Yaldhurst, Christchurch	9·1	..	2
Roper, P. F., R.M.D., Halkett	9·1	..	1
King, W. H., Rosewill, Timaru	9·0	0·3	4
Petrie, J., jun., Swannanoa (line B)	9·0	..	5
Robinson, R. G., Papanui	9·0	..	1
Smith, E. A., R.M.D., Lincoln	9·0	1·0	20
Moore, H. S., Box 4, Kaiapoi (line A)	8·9	0·3	2
Wolff, R. G., R.M.D., Horrelville	8·9	..	5
Pretsch, F. J., 257 Wairarapa Road, Bryndwr	8·8	1·0	2
Rangiora High School, Rangiora (line A)	8·8	0·8	1
Burgess, D., West Plains, Southland	8·7	0·3	1
Needham, M. R., North Road, Kaiapoi (line B)	8·7	0·4	1
Rathgen, A. E., R.M.D., Leeston	8·7	1·2	3

LIST OF GROWERS—*continued.*

Name and Address.	Cropping-power in Tons per Acre.	Percentage of Foreign Varieties.	Acreage.
Aucklander Short-top—continued.			
Canterbury Agricultural College, Lincoln	8·6	1·7	2
Cross, H. E., Sandy Knolls	8·6	..	3
Haines, C., 108 Waimak Road, Harewood	8·6	..	2
Moore, H. S., Box 4, Kaiapoi (line B)	8·6	..	3
Heron, F., R.M.D., Rangiora	8·5	1·0	72
Relling, H., Tycho R.D., Timaru	8·5	..	3
Cross, S., R.M.D., Weedon's	8·3	..	2
McMullan, J. D., North Road, Kaiapoi (line A)	8·3	..	20
Warren, J., 149 Russley Road, Fendalton (line A)	8·3	1·0	25
Petrie, J., jun., Swannanoa (line C)	8·2	1·3	4
Barnett, R., Dunsandel	8·1	0·2	9
Gudex, G., Levels, Timaru	8·0	..	2
Warren, J., 149 Russley Road, Fendalton (line B)	8·0	1·0	5
Bishop, R. G., R.M.D., Southbridge	7·8	..	2
Carroll, A. D., R.M.D., Southbridge	7·8	0·6	8
Jellie, J., Russley Road, Fendalton (line B)	7·8	..	1
Mulcock, F. J., Ryan's Road, Christchurch	7·8	..	5
Needham, M. R., North Road, Kaiapoi (line A)	7·8	..	4
Petrie, J., jun., Swannanoa (line A)	7·8	1·6	2
Shea, F., Makikiki	7·8	..	3
Sloan, Mrs. M., Lakeside	7·8	1·0	6
Weeber, H., Enfield Road, Belfast	7·8	..	5

Cropping-powers (in tons per acre) of lines which have been rejected or withdrawn: 10·2, 9·7, 9·6, 9·5, 9·3, 9·1, 8·5, 8·3, 8·2, 7·9, 7·9, 7·8, 7·7, 7·7, 7·7, 7·6, 7·6, 7·5, 7·5, 7·5, 7·3, 7·3, 7·2, 7·2, 7·1, 7·0, 6·9, 6·8, 6·8, 6·7, 6·7, 6·6, 6·4, 6·3, 6·2, 6·1, 5·7, 5·6, 5·3, 5·1, 3·7.

Dakota :—			
Marshall, D., R.M.D., Leeston	10·1	..	5
Eder, W., R.M.D., Sefton	9·9	..	19
Gardiner, O. J., R.M.D., Dunsandel	9·8	..	6
Cross, H. E., Sandy Knolls (line A)	9·7	..	2
Chambers, A. J., West Melton	9·2	..	3
McPhail, W. A., Mitcham, via Rakaia	9·2	..	6
Cross, H. E., Sandy Knolls (line B)	9·1	..	5
Barnett, R., Dunsandel	9·0	..	6
Cross, S., R.M.D., Rolleston	8·9	..	6
Wolff, R. G., R.M.D., Horrelville	8·9	..	1
Allison, J., Weedon's	8·8	..	1
Dulieu, H. P., Greenpark, Tai Tapu	8·8	..	2
Tweedy, S., R.M.D., Dunsandel	8·8	..	5
Shellock, W., Mead Settlement, Rakaia	8·7	..	1
Walker, C. E., R.M.D., West Melton	8·7	..	5
Anderson, S. H., Lyndhurst, Methven	8·6	..	1
Burrowes, J., Mitcham, via Rakaia	8·6	..	10
Dolan, M., Leeston	8·5	..	2
Frazer, R. W., Southbrook, Rangiora	8·5	0·1	4
Jones, C. H., R.M.D., Methven	8·5	..	5
McGregor, M., Windermere, Ashburton	8·4	..	5
Petrie, J., jun., Swannanoa	8·4	..	2
Rolston, G., R.M.D., Weedon's	8·3	..	3
Gardiner, C., Mitcham, Rakaia	8·2	..	1
Adams, D., Highbank, Methven	8·0	0·7	2
Hinton Bros., Templeton	8·0	..	13
McNae, F., R.M.D., Courtenay	8·0	..	15
Murphy, H. E., R.M.D., Weedon's	7·9	..	4
Upston, E. E., Selwyn	7·9	..	5

Cropping-powers (in tons per acre) of lines which have been rejected or withdrawn: 9·8, 9·3, 8·7, 7·8, 7·8, 7·7, 7·7, 7·6, 7·6, 7·6, 7·4, 7·3, 7·3, 7·2, 7·1, 7·0, 6·9, 6·9, 6·7, 6·6, 6·5, 6·5, 6·5, 6·4, 6·0, 5·9, 5·0, 4·3.

LIST OF GROWERS—*continued.*

Name and Address.	Cropping-power in Tons per Acre.	Percentage of Foreign Varieties.	Acreage.
Aucklander Tall-top :—			
Cross, H. E., Sandy Knolls (line B)	10·5	..	3
Government Pure Seed Station, Box 4, Lincoln	10·0	..	..
Frost, C. H., P.O., Balcairn	9·9	..	5
Bailey, J., R.M.D., Kaiapoi	9·5	..	7
Brown, H. M., 114 Withell's Road, Riccarton, Christchurch	9·5	..	12
Simmons, W., Kingsdown, Timaru	9·1	..	3
Doak, J. H., Barrhill, Rakaia	9·0	..	2
Dulieu, H. P., Tai Tapu	9·0	..	2
Cross, H. E., Sandy Knolls (line A)	8·9	..	2
Warren, J., 149 Russley Road, Fendalton	8·9	1·0	6
N.Z. Loan and Mercantile Agency Co., Cashel Street, Christchurch	8·8	..	5
Steele, J., R.M.D., Darfield	8·8	1·2	2
Doak, A., Rangiora	8·7	..	2
Heckler, J. L., Mauriceville, via Masterton	8·7	0·3	2
Crowe, E., Waimate	8·6	..	5
Hewson, R. H., Seadown, Timaru	8·6	..	2
Guy Bros., Springbank, R.M.D., Rangiora (line A)	8·5	..	5
Frazer Bros., Southbrook, Rangiora	8·4	..	6
Aicken, W. R., Dyerville, Martinborough	8·3	..	1
Hills, W., Oxford Road, Rangiora	8·3	..	3
Ryan, P. F., R.M.D., Springston	8·3	..	6
Steele, D., R.M.D., Ohoka	8·3	..	5
Watkins, E. R., Springbank, Rangiora	8·3	..	6

Cropping-powers of lines rejected or withdrawn: 9·0, 8·9, 8·2, 8·2, 8·1, 8·0, 8·0, 7·9, 7·7, 7·6, 7·6, 6·4, 5·9, 5·6, 4·5, 3·2.

Up-to-Date :—			
Government Pure Seed Station, Box 4, Lincoln	10·5	..	..
Norman, H. D., Tuatapere	9·6	0·9	2
Kokay, S., Tuatapere	9·4	..	6
Robinson, R. G., Papanui	9·3	..	1
Butcher, D. and M., R.M.D., Broadfields	9·2	..	1
Manson, D. J., Enfield, Oamaru	9·2	..	1
Walker, C. E., R.M.D., West Melton	9·1	..	5
Gray, J. L., St. Andrews	9·0	..	2
Stewart, A., Marsh's Road, Templeton	9·0	..	1
Smyth, H., care of G. Manson, R.M.D., Darfield	9·0	..	1
Tutton, F. A., R.M.D., Broadfields	9·0	..	2

Cropping-powers of lines rejected or withdrawn: 9·0, 9·0, 9·0, 8·8, 8·0, 7·9.

Arran Chief :—			
Knowler, H., Te Waewae	10·1	0·3	2
Saunders, E. E., Studholme Junction	9·6	..	2
King, R. M., Tuatapere (line A)	9·3	1·2	1
Teschner, C. A., Chatton Road, Gore	9·3	0·4	1
Knowler, C. E., Happy Valley, Tuatapere	9·1	0·6	1
Townshend, R. C., R.M.D., Darfield	8·0	..	2
Frazer Bros., Southbrook, Rangiora	7·9	0·5	3
Watkins, E. R., Springbank, Rangiora	7·9	..	1
Grant, A., Waimate	7·6	1·0	3
Bell, J. F., Stirling	7·5	0·5	5
Dulieu, H. P., Tai Tapu	7·3	..	2
Anderson, A., Stirling	7·2	0·4	1
Kirkpatrick, W. T., Airedale R.D., Oamaru	7·2	0·8	2

Cropping-powers of lines rejected or withdrawn: 9·0, 7·3, 7·1, 7·1, 7·1, 7·0, 6·7, 6·2, 6·1, 6·0, 5·3, 3·7.

LIST OF GROWERS—*continued.*

Name and Address.	Cropping-power in Tons per Acre.	Percentage of Foreign Varieties.	Acreage.
King Edward :—			
Milburn, M., Wright's Bush, Invercargill	8·2	0·2	1
Teschner, C. A., Chatton Road, Gore	8·1	..	1
Kokay, S., Tuatapere	8·0	..	2
Burgess, D., West Plains, Southland	7·4	0·4	2
Brown, W. E., Orepuki	7·2	0·4	2
King, W. S., The Bend, Winton	7·1	0·3	1
Caulfield, J. T., Rakahauka R.D., Glencoe, Invercargill	7·0	..	1
King, L. A., Rakahauka R.D., Glencoe, Invercargill	6·9	0·1	3
Anderson, A., Stirling	6·8	0·3	4
Knowler, C. E., Happy Valley, Tuatapere	6·6	0·1	2
Knowler, H., Te Waewae, Southland	6·6	1·0	2
Cropping-powers of lines rejected or withdrawn: 6.5, 6.3, 6·2, 5·8, 5·6, 5·4.			
Epicure :—			
Carroll, J., Southbridge	6·3*	..	1
Barnett, R., Dunsandel	6·2*	..	3
Tweedy, S., R.M.D., Dunsandel	6·1*	..	1
Carroll, A. D., R.M.D., Southbridge	6·0*	..	1
Moriarty, L., Southbridge	6·0*	..	1
McLachlan, G., R.M.D., Southbridge	5·3*	..	20
Robinson, R. G., Papanui	5·2*	..	2
Shellock, W., Mead Settlement, Rakaia	5·2	..	2
Cropping-powers of lines rejected or withdrawn: 5·1,* 4·8, 4·5,* 4·2, 3·5, 3·2, 3·2, 3·1.			
* These lines are taller-growing and rather later-maturing than the usual Epicure, but not a typical "bolter" type.			
Bresee's Prolific :—			
Marshall, D., R.M.D., Leeston	8·2	c·8	20
Ford, S., Templeton	7·4	0·7	2
Butcher, D. and M., R.M.D., Broadfields	7·1	..	3
Guy, T. A., Yaldhurst, Christchurch	6·8	0·5	6
Cropping-powers of lines rejected or withdrawn: 6·2, 6·0, 5·8, 5·7, 5·6.			
Iron Duke :—			
Government Pure Seed Station, Box 4, Lincoln	8·6	..	..
Buchanan, A. R., Kairanga, Palmerston North	7·7	..	3
Spillane, A., Temuka	7·4	0·3	1
Seyb, L., Washdyke, Timaru	7·2	1·5	1
Robinson, R. G., Box 4, Papanui	6·8	..	2
Cropping-powers of lines rejected or withdrawn: 6·8, 6·8, 5·8, 5·6.			
Majestic :—			
Government Pure Seed Station, Box 4, Lincoln	8·8	..	..
Robinson, R. G., Box 4, Papanui (line A)	7·9	..	1
Robinson, R. G., Box 4, Papanui (line B)	7·7	..	1
Cropping-powers of lines rejected or withdrawn: 7·5, 6·5, 6·4.			
Early Rose :—			
Burns, R. A. C., Mead Settlement, Rakaia	8·0	..	4
Weaver, J., R.M.D., Te Pirita	7·9	..	3
Poulton, A. D., R.M.D., West Eyreton	6·8	1·3	1
Cropping-powers of lines rejected or withdrawn: 5·6, 5·3, 4·3.			

LIST OF GROWERS—*continued.*

Name and Address.	Cropping-power in Tons per Acre.	Percentage of Foreign Varieties.	Acreage.
Robin Adair :—			
Marshall, D., R.M.D., Leeston	7·6	..	3
Robinson, R. G., Box 4, Papanui	7·2	..	1
Brown, A. F., 92 Woolridge Road, Harewood ..	6·8	..	1
Cropping-power of line rejected: 5·5.			
Field Marshal :—			
Wright, L. T., Annat	9·0	..	13
Gray, J. L., St. Andrews	8·9	..	2
Robinson, R. G., Box 4, Papanui	8·9	..	2
Cropping-power of line rejected: 7·8.			
Great Scot :—			
Government Pure Seed Station, Box 4, Lincoln ..	9·0	..	..
Robinson, R. G., Papanui	7·4	1·0	1
Cropping-power of line rejected: 7·1.			
Arran Victory :—			
Smyth, H., care of G. Manson, R.M.D., Darfield ..	9·0	..	1
Cropping-power of line rejected: 6·2.			
Early Regent Bolter :—			
Oakley, W., R.M.D., Halkett	10·5	..	4
Cropping-power of line rejected: 8·0.			
Ally :—			
Government Pure Seed Station, Box 4, Lincoln ..	4·2	..	..
Cropping-power of line rejected: 3·2.			
Arran Banner :—			
Government Pure Seed Station, Box 4, Lincoln ..	8·5	..	..
McNae, F., R.M.D., Courtenay	8·5	..	3
Endurance :—			
Burns, R. A. C., Mead Settlement, Rakaia	10·9	..	1
Cropping-power of line withdrawn: 9·6.			
Abundance :—			
Government Pure Seed Station, Box 4, Lincoln ..	9·0	..	..
Kerr's Pink :—			
Government Pure Seed Station, Box 4, Lincoln ..	8·2	..	..
Arran Consul :—			
Government Pure Seed Station, Box 4, Lincoln ..	8·0	..	..
British Queen :—			
Government Pure Seed Station, Box 4, Lincoln ..	5·2	..	..
Sharpe's Express :—			
Government Pure Seed Station, Box 4, Lincoln ..	4·4	..	..
Jersey Bennes :—			
Government Pure Seed Station, Box 4, Lincoln ..	4·3	..	..
May Queen :—			
Government Pure Seed Station, Box 4, Lincoln ..	4·3	..	..
Di Vernon :—			
Government Pure Seed Station, Box 4, Lincoln ..	4·2	..	..

LIST OF GROWERS—*continued.*

Name and Address.	Cropping-power in Tons per Acre.	Percentage of Foreign Varieties.	Acreage.
Witchhill :—			
Government Pure Seed Station, Box 4, Lincoln ..	4·0	..	..
Eclipse :—			
Government Pure Seed Station, Box 4, Lincoln ..	3·7	..	..
Northern Star :—			
Robinson, R. G., Papanui	7·4	..	2
Early Puritan :—			
Cropping-power of line withdrawn: 2·4.			

—*Fields Division.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

FEEDING OF CONCENTRATES TO DAIRY COWS IN EARLY PART OF SEASON.

R. H. C., Inglewood :—

We contemplate the adoption of "hard feeding" in the coming season, and propose using a mixture of fifty-fifty bran and meat-meal, which would be fed to the cows during milking-time. This hard feeding would be in operation during the period from calving-time until the new grass comes away —say, from the last week in July until the middle of October—the objective being the maintenance of the milk production at the maximum, with avoidance of the temporary decline which otherwise occurs during the period in question. We should be obliged if you would indicate what in your opinion would be a suitable quantity of feed per cow of the above-mentioned mixture, and whether to obtain the best results it should be fed at one issue or both night and morning. Assuming that a quantity of bran and meat-meal is fed to the cows during milking-time, what should be the average ration of hay and ensilage under conditions where the "roughage" is very scanty.

The Live-stock Division :—

The feeding of concentrates to dairy stock during the early part of the milking season is a practice which may be extended with advantage. During this period there is a scarcity of grass, and a ration of hay and ensilage is not sufficiently rich in productive materials to maintain a high milk-yield. The ration may be supplemented with meat-meal and bran. Some difficulty may be found in getting cows to eat meat-meal at first. In this respect it is advisable to train the cows to feed from boxes, commencing with a ration of ¼ lb. meat-meal with 2 lb. of bran per head twice daily. When the cows become accustomed to the meat-meal it may be increased to ½ lb. per head twice daily, the bran ration remaining the same. It is therefore advisable to feed the ration in the proportion of one part of meat-meal to four parts of bran. A good quality of meat-meal should be used, free from fibre and containing the minerals in a finely ground state. Feed twice daily for preference. The above may be used as a basal ration for all cows. Strictly speaking, high-producing cows will receive more of the mixture than low-producing animals. The ration of ensilage and hay cannot definitely be stated in terms of pounds weight, as a good deal depends upon the breed of cattle, their general condition, and the amount of roughage available. As a

guide it may be stated that about 10 lb. of hay with 30 lb. of ensilage may be fed daily per head in the case of Jersey cows. For economy purposes, where the herd is not too large, it is advisable to feed this portion of the ration from movable racks.

DESTROYING STINGING NETTLES WITH SODIUM CHLORATE SPRAY.

"NETTLED," Upper Hutt :—

I should be glad if you could advise me as to the best means of getting rid of stinging nettle, which is spreading rapidly in my poultry-runs. It grows so rapidly in cultivated ground that it threatens to oust grass or any other desired plant.

The Fields Division :—

Stinging nettles are easily eradicated by spraying with a 5-per-cent. solution of sodium chlorate. This chemical is not poisonous to animals, and the vegetation in the fowl-runs can be sprayed without shifting the birds. Clothing which has been saturated with the mixture should be rinsed out in clean water immediately afterwards; otherwise, if allowed to dry, it is liable to fire, and for this reason no smoking should be allowed while handling the fluid.

KILLING MACROCARPA-TREES WITH POISON.

J. D. WATKINS, Kopaki :—

I noticed in the March *Journal* that it is possible to kill willow-tree with arsenic. Can you tell me if this can be done for macrocarpas too, and, if so, how much arsenic is needed, and is it put in dry or in solution? Is there anything better than arsenic for killing them? I have some macrocarpas which I want to kill, but not to cut at present, and if there is some way of poisoning them that will be easily the best thing to do.

The Horticulture Division :—

The macrocarpa cypress trees may be destroyed in the same way as the willows—that is, by boring the trunk with an auger in a sloping direction, filling the holes with any weed-killer, and plugging them afterwards to prevent evaporation. The arsenic weed-killer is made as follows: Thoroughly mix 1 lb. arsenic and ¼ lb. caustic soda in a tin, add water gradually and stir till the arsenic is dissolved, then make it up to 4 gallons. The mixture is very poisonous and should be carefully handled. The utensils should not be used for any other purpose.

VAGINITIS IN COWS.—MINERAL REQUIREMENTS OF PIGS.

H. B. IGGULDEN, Norsewood :—

Can you let me have (1) a reliable remedy or treatment for vaginitis, and (2) a recipe of a mineral mixture that I could mix and feed to pigs.

The Live-stock Division :—

(1) No importance is attached to the presence of small nodules or "granules" on the vaginal membrane, in so far as sterility is concerned. Where vaginitis of a pustular nature is present, with discharge, such cows should not be allowed near the bull, and the vaginal passage should be washed out daily for a week with a solution made by adding one ½ oz. of Lugol's solution of iodine to a quart of water.

(2) The mineral requirements of pigs are met by the use of meat-meal in the diet. Meat-meal being not only rich in protein but also in minerals. If desired, a meat-meal containing 20 per cent. of bone-meal can be used. The quantities fed will approximately be for weaner pigs about 4 oz. daily, increasing to 6 oz.; for pigs three months or older ½ lb. per day. Sows in pig can be given ½ lb. per day, and a few days after farrowing should receive 1 lb. daily until the piglets are weaned